AD-A134 242 CLEVELAND HARBOR OHIO SECTION 3 STUDY TERMINATION REPORT(U) CORPS OF ENGINEERS BUFFALO NY BUFFALO DISTRICT APR 83 1/3

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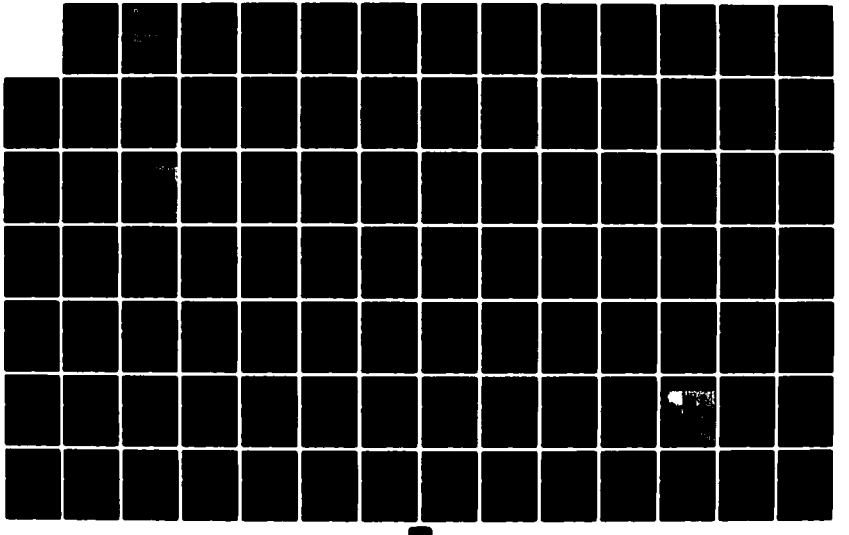
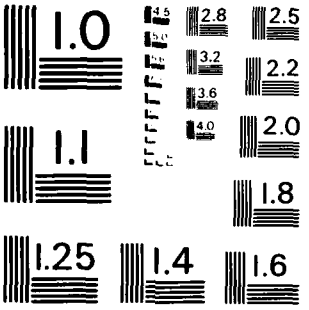




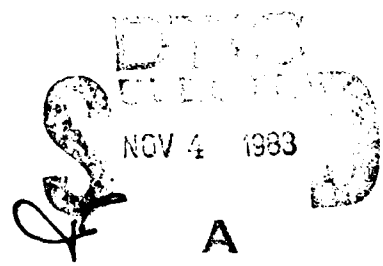
US Army Corps
of Engineers
Buffalo District

(12)

Cleveland Harbor, Ohio
Section III Study

AD-A134 142

Termination Report



April 1983

study area. From this analysis, it was determined that the only identifiable impacted areas due to the harbor project were those immediately adjacent to the harbor area (Bratenahl and Perkins Beach). The Bratenahl shoreline to the east and the Perkins Beach area on the west have been negatively affected due to denial of sand-sized material from the littoral system as a result if maintenence dredging in the Cuyahoga River. Plans for mitigating these damages were also developed and evaluated. From this evaluation, two plans were selected from implementation: Plans IIA and IIB. These plans provide for disposal of suitable, sand-sized material dredged from the Cuyahoga River in offshore areas opposite Bretenahl and Perkins Beach, respectively. The dredged material would then enter the littoral system in sufficient quantity to totally mitigate the Federally induced damages to the shoreline.

SYLLABUS
CLEVELAND HARBOR SECTION 111

TERMINATION REPORT

At the request of the Mayor of the village of Bratenahl in April 1975, the Buffalo District initiated a study to determine what effects, if any, the Federal Harbor project at Cleveland, OH, may have had on the adjoining beaches and shoreline under the Section 111 Authority. This authority provides for the investigation and construction of projects for the prevention and/or mitigation of shore damages attributable to Federal navigation works.

The Reconnaissance Report for this study, the first phase of the study process, was completed in 1977 and concluded that the navigation improvements and maintenance dredging practices at Cleveland Harbor reduces the supply of sand-sized material in the predominantly west to east littoral zone and caused starvation of beaches and offshore areas. The Reconnaissance Report also recommended that a detailed study, to define the Federal responsibility, be completed. Upon receipt of funding, this detailed study phase was initiated in Fiscal Year 1982.

An extensive area from the Cuyahoga-Lake County line on the east to the Rocky River on the west was investigated to determine the effects of the Cleveland Harbor structures and maintenance dredging program on the shoreline. Long-term erosion rates were developed and compared for each of 14 reaches within the study area. From this analysis, it was determined that the only identifiable impacted areas due to the harbor project were those immediately adjacent to the harbor area (Bratenahl and Perkins Beach). The Bratenahl shoreline to the east and the Perkins Beach area on the west have been negatively affected due to denial of sand-sized material from the littoral system as a result of maintenance dredging in the Cuyahoga River. Plans for mitigating these damages were also developed and evaluated. From this evaluation, two plans were selected for implementation: Plans IIA and IIB. These plans provide for disposal of suitable, sand-sized material dredged from the Cuyahoga River in offshore areas opposite Bratenahl and Perkins Beach, respectively. The dredged material would then enter the littoral system in sufficient quantity to totally mitigate the Federally induced damages to the shoreline.

With the extent of Federally induced damages to the shoreline adjacent to Cleveland Harbor established and the proposed method of mitigating these damages determined, further study under the Section 111 Authority was deemed unwarranted and the study was terminated. The recommended plan of mitigation will be implemented by the Buffalo District under the ongoing maintenance program for Cleveland Harbor. This Termination Report will provide the basis and authorization for the District to take over and carry out the recommended nourishment program as part of the Operation and Maintenance Program for Cleveland Harbor.

CLEVELAND HARBOR, OHIO
SECTION 111

TABLE OF CONTENTS

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TABLE OF CONTENTS (Cont'd)

TABLE OF CONTENTS (Cont'd)

TABLES

APENDICIES

TERMINATION REPORT
CLEVELAND HARBOR, OH

SECTION 111

STUDY ORIGINATION

The study was initiated at the request of the village of Bratenahl by letter dated 9 April 1975 (see Figure 1).

AUTHORITY

The basic authority for the investigation is Section 111 of the River and Harbor Act of 1968 (PL 90-483, approved 13 August 1968) which states:

"The Secretary of the Army, acting through the Chief of Engineers is authorized to investigate, study and construct projects for the prevention or mitigation of shore damages attributable to Federal navigation works. The cost of installing, operation, and maintenance shall be borne entirely by the United States. No such projects shall be constructed without specific authorization by Congress if the estimated cost exceeds $1,000,000."

PURPOSE

The purpose of this investigation is to determine whether the Federal navigation project at Cleveland Harbor has caused, or substantially increased the erosion of the shore and/or beaches east and west of the harbor, and if so, to determine what measures are justified to mitigate the induced damages.

PREVIOUS REPORT

A Reconnaissance Report addressing shoreline erosion in the Cleveland Harbor area was completed by the Buffalo District in March 1977. It concluded that the only identifiable impact of the navigation project at Cleveland, OH, was one of denial of sand-sized material to offshore areas within the littoral zone due to dredging of the upper Cuyahoga River. The report recommended that further study be performed to determine the quality and amount of suitable material available from the dredging process, to consider alternative mitigation plans, to study the effects of all considered plans on the environment, and to determine the justification for adopting a mitigation plan.

LOCATION OF FEDERAL PROJECT

Cleveland Harbor, OH, (see Figure 2) is located on the south shore of Lake Erie, at the mouth of the Cuyahoga River, approximately 176 miles southwest of Buffalo, NY, and 96 miles east of Toledo, OH. The harbor includes a breakwater protected Lakefront Harbor and an Inner Harbor consisting of improved navigation channels on the Cuyahoga River and Old River. The harbor area is shown on Figures 3 and 4, following.

BRATENAHL VILLAGE

BRATENAHL VILLAGE HALL • 411 BRATENAHL ROAD
CLEVELAND, OHIO 44108
AREA CODE 216 - 681 1234

April 9, 1975

Colonel Bernard C. Hughes
District Engineer
Department of the Army
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Hughes:

The Council of the Village of Bratenahl respectfully requests that the Corps of Engineers conduct a survey to determine what effects, if any, the existence of the East breakwater, and other similar improvements under the jurisdiction of the Corps, at Cleveland Harbor may have on the beaches and shore line within the limits of the Village of Bratenahl.

As you are aware, lake front properties in the Village have experienced considerable beach starvation and shore line erosion. There is concern that harbor works, previously undertaken by the Corps, have been a significant contributing factor to this degenerating condition.

Your earliest possible attention to this request will be appreciated.

Sincerely yours,

William A. Klein

William A. Klein, Mayor

FIGURE 1

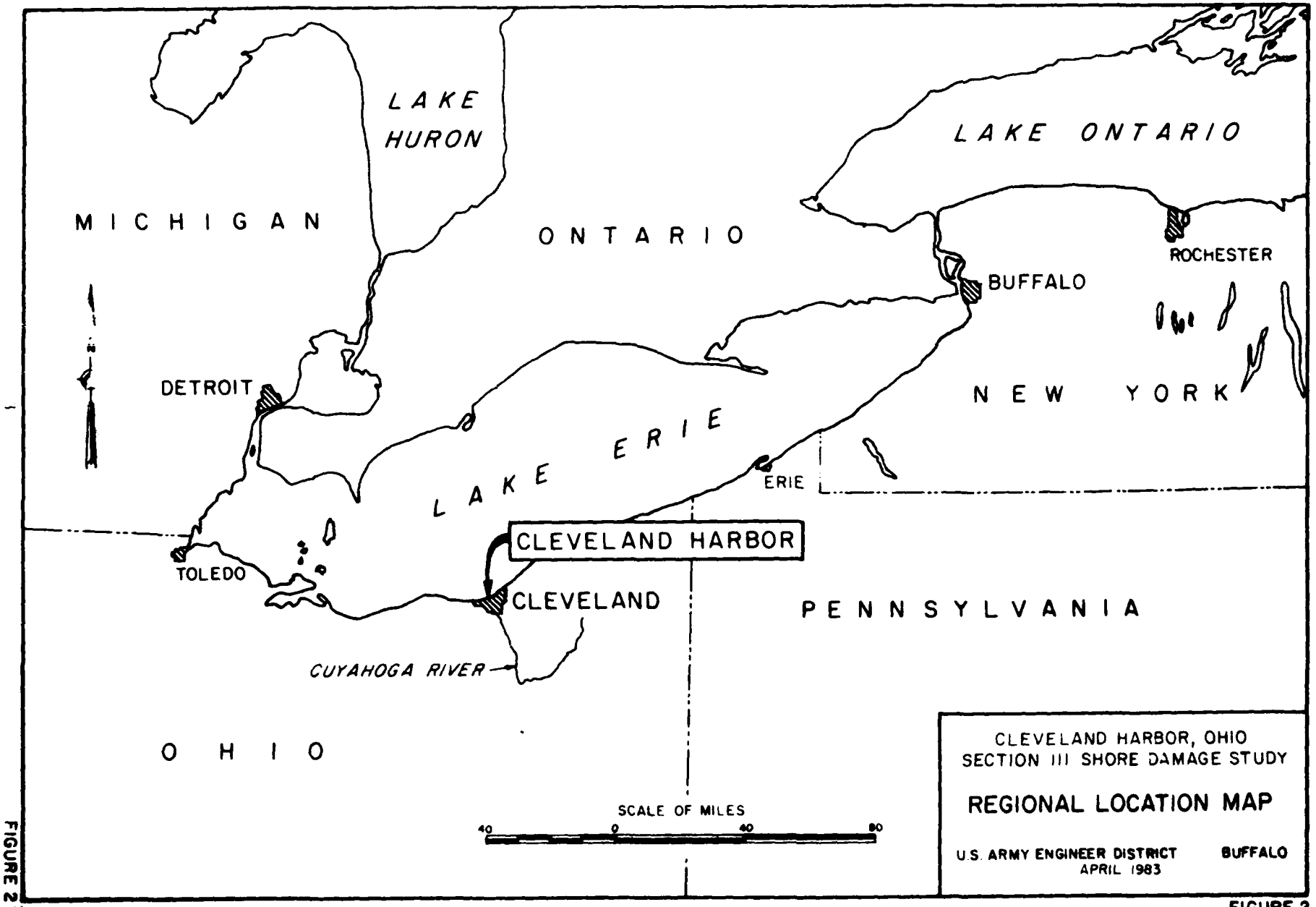
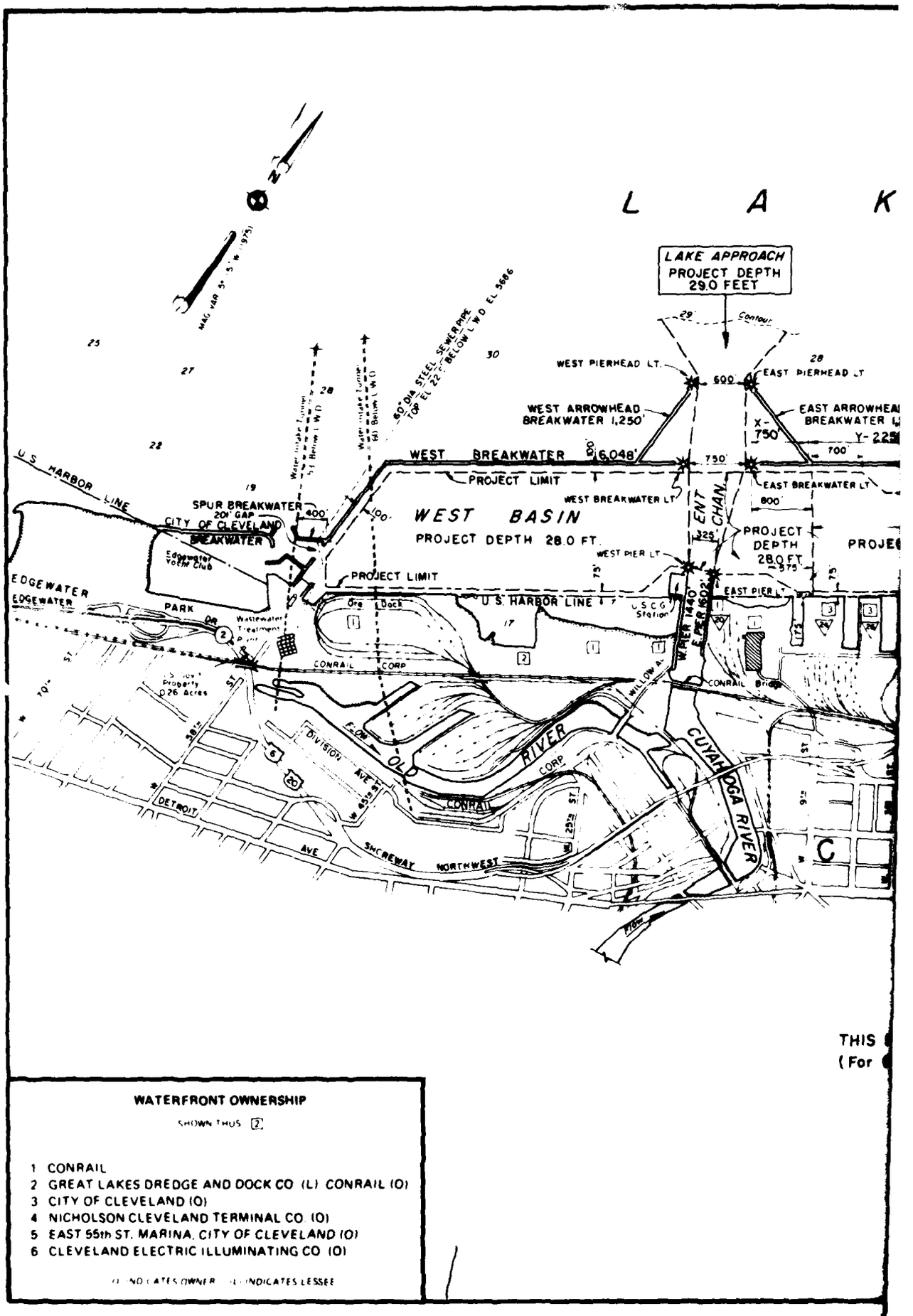


FIGURE 2

FIGURE 2



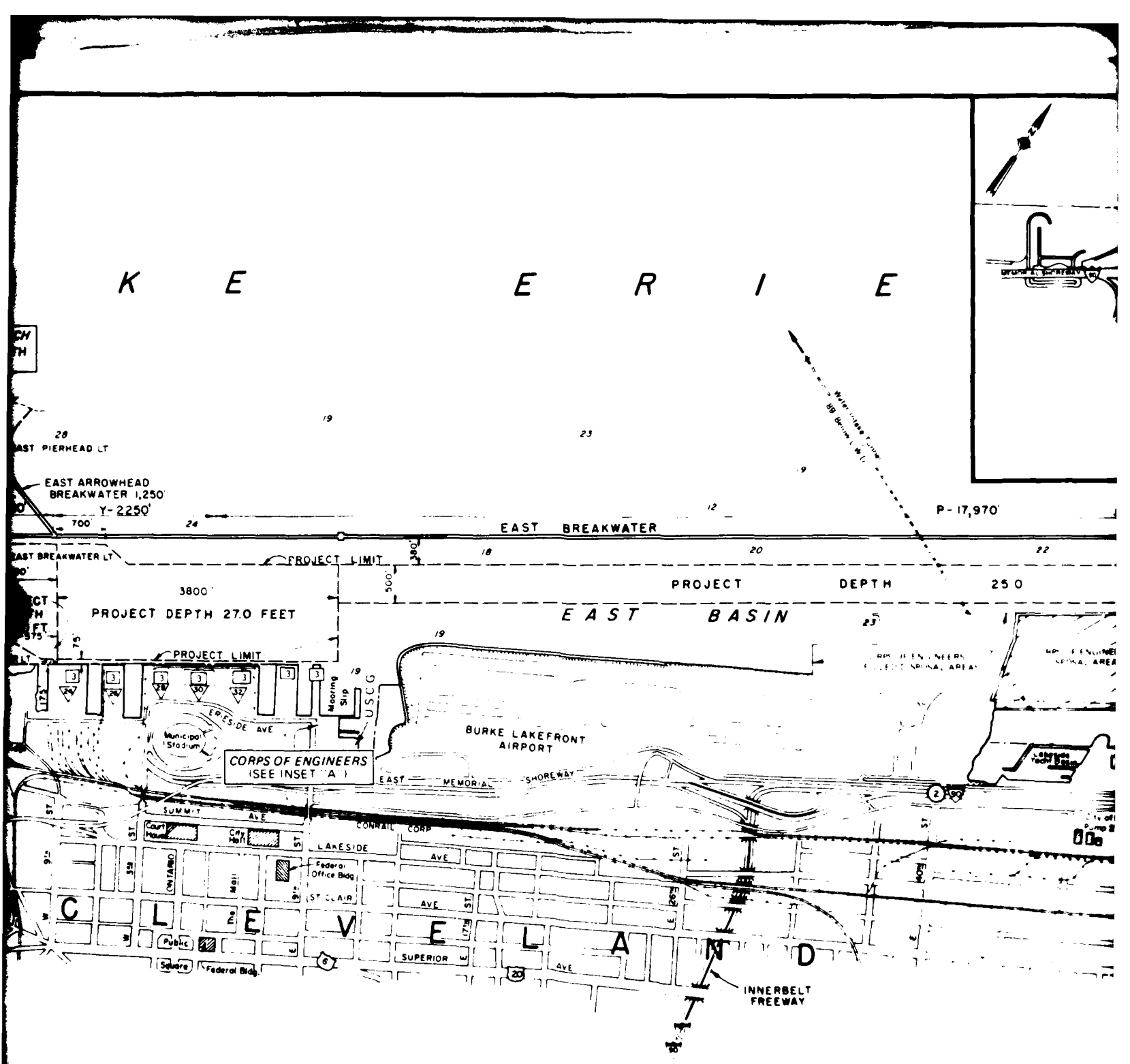
THIS
(For

WATERFRONT OWNERSHIP

SHOWN THUS [2]

1 CONRAIL
2 GREAT LAKES DREDGE AND DOCK CO (L) CONRAIL (O)
3 CITY OF CLEVELAND (O)
4 NICHOLSON CLEVELAND TERMINAL CO. (O)
5 EAST 55th ST. MARINA, CITY OF CLEVELAND (O)
6 CLEVELAND ELECTRIC ILLUMINATING CO (O)

(O) INDICATES OWNER (L) INDICATES LESSEE

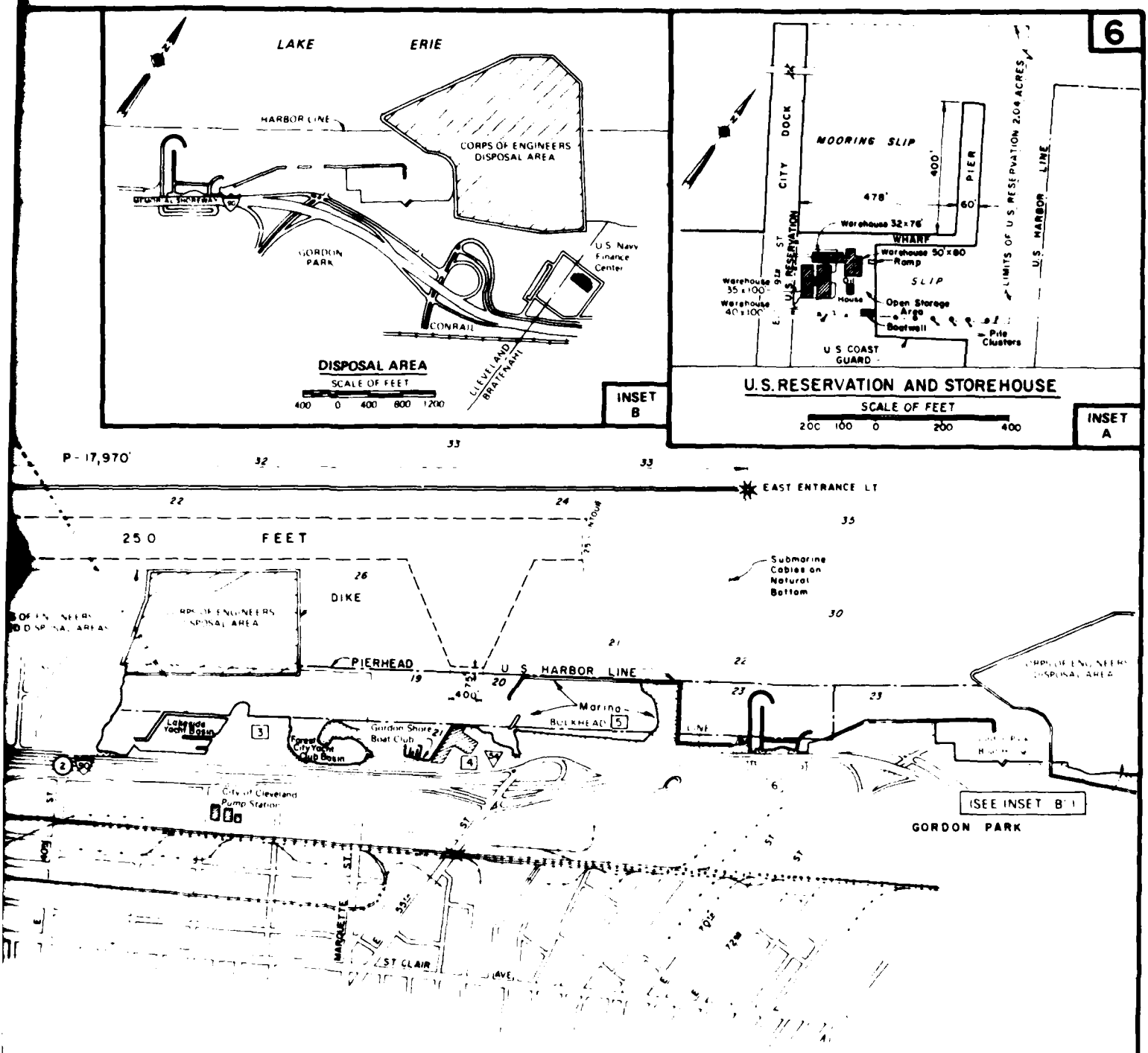


THIS IS OUTER HARBOR SECTION
(For Cuyahoga River section, see Map 6 A)

NOTES

PROJECT DEPTHS AND SOUNDINGS ARE REFERRED TO LOW WATER DATUM, EL. 568.6 FEET ABOVE MEAN WATER LEVEL AT FATHER POINT, QUEBEC (IGLD 1955) (INTERNATIONAL GREAT LAKES DATUM 1)

- (6) INDICATES U.S. ROUTE
- (2) INDICATES STATE ROUTE
- INDICATES INTERSTATE ROUTE
- INDICATES CITY OF CLEVELAND DOCK NUMBERING SYSTEM



NOTES

PTHS AND SOUNDINGS ARE REFERRED
ER DATUM, EL. 568.6 FEET ABOVE
N LEVEL AT FATHER POINT, QUEBEC
INTERNATIONAL GREAT LAKES DATUM 1955)

ATES U.S ROUTE

ATES STATE ROUTE

ATES INTERSTATE ROUTE

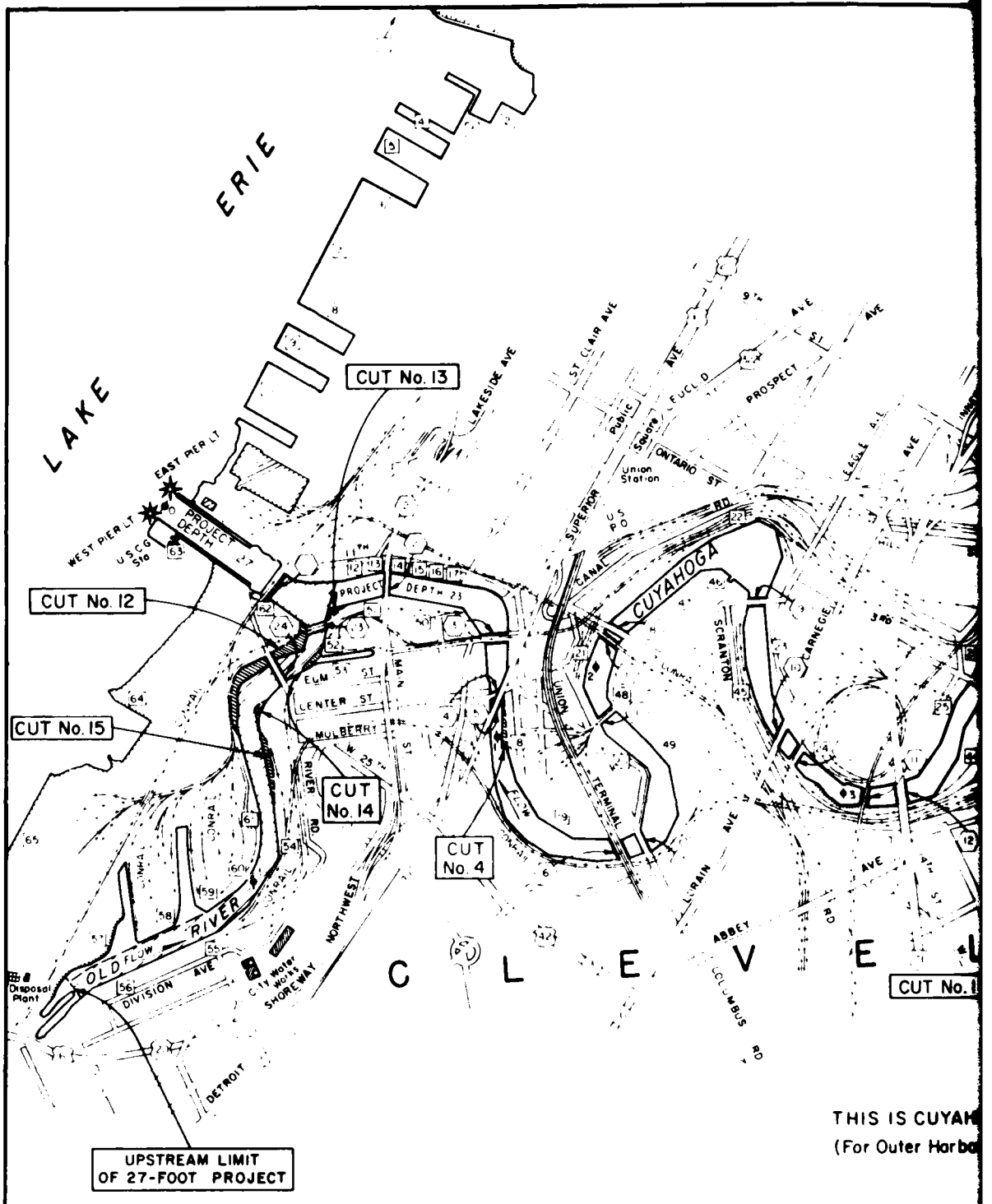
ATES CITY OF CLEVELAND DOCK
BERING SYSTEM

CLEVELAND HARBOR
OHIO

SCALE OF FEET
1000 0 1000 2000

U.S. ARMY ENGINEER DISTRICT BUFFALO
30 SEPTEMBER 1977

FIGURE 3



THIS IS CUYAH

(For Outer Harbo

NOTES

PROJECT DEPTHS — 27.0 FEET IN LOWER CUYAHOGA RIVER TO JUNCTION WITH OLD RIVER AND 23.0 FEET IN REMAINDER OF CUYAHOGA RIVER
18.0 FEET IN TURNING BASIN AT MILE 4.8 ON CUYAHOGA RIVER
27.0 FEET IN OLD RIVER

PROJECT DEPTHS AND SOUNDINGS ARE REFERRED TO LOW WATER DATUM, ELEVATION 568.6 FEET ABOVE MEAN WATER LEVEL AT FATHER POINT, QUEBEC (IGLD 1955) INTERNATIONAL GREAT LAKES DATUM (1955)

MILES ABOVE WEST PIER LIGHT AT OUTER END OF WEST PIER SHOWN THUS 2.4

(90) INDICATES U.S. ROUTES

(2) INDICATES STATE ROUTES

(71) INDICATES INTERSTATE ROUTE

AR

CUYAHOGA RI
UPSTREAM OF
RIVER

OLD RIVER P
JUNCTION WIT
PRODUCTS CO
21.0 FEET

INDEX TO BRIDGES

SHOWN THUS (1)

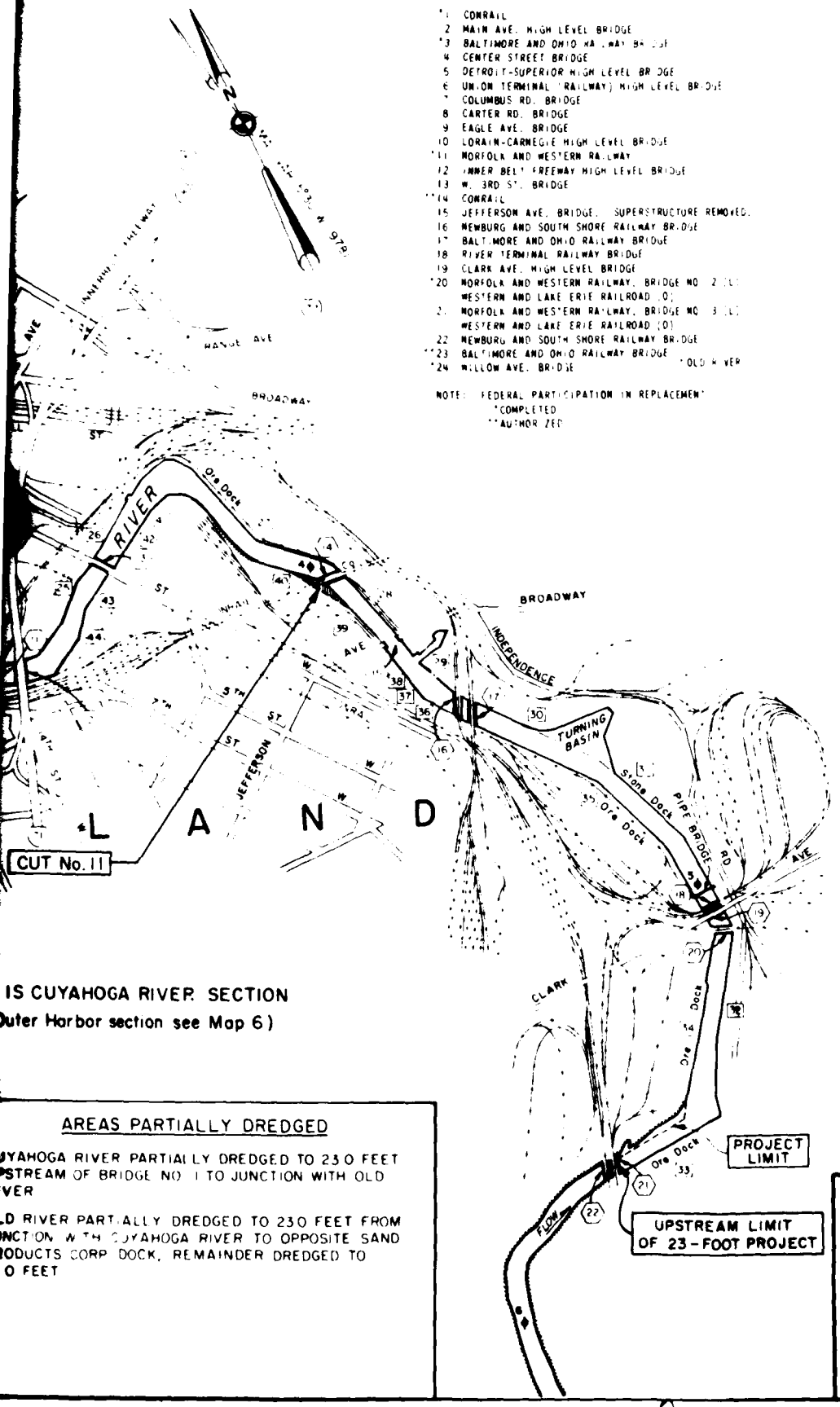
*1	CONRAIL
2	MAIN AVE. HIGH LEVEL BRIDGE
*3	BALTIMORE AND OHIO RAILWAY BRIDGE
4	CENTER STREET BRIDGE
5	DETROIT-SUPERIOR HIGH LEVEL BRIDGE
6	UNION TERMINAL (RAILWAY) HIGH LEVEL BRIDGE
*	COLUMBUS RD. BRIDGE
8	CARTER RD. BRIDGE
9	EAGLE AVE. BRIDGE
10	LORAIN-CARNEGIE HIGH LEVEL BRIDGE
*11	NORFOLK AND WESTERN RAILWAY
12	INNER BELT FREEWAY HIGH LEVEL BRIDGE
13	W. 3RD ST. BRIDGE
**14	CONRAIL
15	JEFFERSON AVE. BRIDGE. SUPERSTRUCTURE REMOVED.
16	NEWBURG AND SOUTH SHORE RAILWAY BRIDGE
17	BALTIMORE AND OHIO RAILWAY BRIDGE
18	RIVER TERMINAL RAILWAY BRIDGE
19	CLARK AVE. HIGH LEVEL BRIDGE
*20	NORFOLK AND WESTERN RAILWAY, BRIDGE NO 2 (L) WESTERN AND LAKE ERIE RAILROAD (O)
21	NORFOLK AND WESTERN RAILWAY, BRIDGE NO 3 (L) WESTERN AND LAKE ERIE RAILROAD (O)
22	NEWBURG AND SOUTH SHORE RAILWAY BRIDGE
**23	BALTIMORE AND OHIO RAILWAY BRIDGE
*24	WILLOW AVE. BRIDGE *OLD RIVER

NOTE: FEDERAL PARTICIPATION IN REPLACEMENT
*COMPLETED
**AUTHORIZED

WATERFRONT OWNERSHIP

SHOWN THUS (1)
O NO DATED OWNER
L NO DATED LESSEE

	NICHOLSON CLEVELAND TERMINAL CO
2	U.S. GOVERNMENT (O) U.S. COAST GUARD (L)
3	U.S. GOVERNMENT (O) U.S. ARMY CORPS OF ENGINEERS (L)
4	CITY OF CLEVELAND
5	CITY OF CLEVELAND (O) JOSEPH METRAMET INC (L)
6	CITY OF CLEVELAND (O) CLEVELAND-CUYAHOGA COUNTY PORT AUTHORITY AND CLEVELAND STEVEDORE CO (L)
7	CITY OF CLEVELAND (O) CLEVELAND-CUYAHOGA COUNTY PORT AUTHORITY AND CLEVELAND STEVEDORE CO (L)
8	CITY OF CLEVELAND (O) CLEVELAND-CUYAHOGA COUNTY PORT AUTHORITY AND CLEVELAND STEVEDORE CO (L)
9	CITY OF CLEVELAND (O) CLEVELAND-CUYAHOGA COUNTY PORT AUTHORITY AND CLEVELAND STEVEDORE CO (L)
10	CITY OF CLEVELAND (O) CLEVELAND-CUYAHOGA COUNTY PORT AUTHORITY AND CLEVELAND STEVEDORE CO (L)
11	CLEVELAND-CUYAHOGA COUNTY PORT AUTHORITY (O) LAKE ERIE ASPHALT PRODUCTS INC (L)
12	JOSEPH WATERS (O) ALPHA CONCRETE CORP. (L)
13	COUNTY OF CUYAHOGA BOARD OF COMM SIONERS
14	RYAN REALTY AND J&P PROPERTIES (O) BEACON-MAUSHEER MAR NE CO (L)
15	JOHN D. SAMSEL (O) SAMSEL ROPE AND MAR NE SUPPLY CO (L)
16	GREAT LAKES TOWING CO
17	SAMSEL REALTY CO. (O) SAMSEL ROPE AND MAR NE SUPPLY CO. AND POLLUTION RECOVERY SYSTEMS (L)
18	CEREAL FOOD PROCESSORS INC
19	CUYAHOGA WIRE CO
20	MEDUSA CEMENT CO
21	CITY OF CLEVELAND
22	BALTIMORE AND OHIO RAILROAD CO
23	MIDDLE CONTINENTAL COAL & COKE CO AND CITY OF CLEVELAND (O) MIDDLE CONTINENTAL COAL & COKE CO (L)
24	FORD MOTOR CO
25	THE CLEVELAND BUILDERS SUPPLY CO
26	UNITED GARAGE AND TERMINAL CORP (O) ONTARIO STONE CORP (L)
27	UNITED STATES STEEL CORP
28	UNITED STATES STEEL CORP
29	MARINE FUEL KING, DIVISION OF RESSLER TERMINAL CORP
30	E.I. DU PONT DE NEMOURS & CO
31	REPUBLIC STEEL CORP
32	REPUBLIC STEEL CORP.
33	REPUBLIC STEEL CORP
34	JONES & LAUGHLIN STEEL CORP
35	REPUBLIC STEEL CORP
36	CHEMICALS, INC.
37	KOPPERS CO., INC.
38	THE CLEVELAND BUILDERS SUPPLY CO
39	GULF OIL REFINING & MARKETING CO
40	MOBIL OIL CORP (O) CLIFTON CONCRETE & SUPPLY CO (L)
41	TEXACO, INC.
42	SHELL OIL CO.
43	THE CLEVELAND BUILDERS SUPPLY CO
44	THE CLEVELAND BUILDERS SUPPLY CO.
45	BRADFORD-CARTER ESTATE (O) EAGLE-SCRANTON CORP (L)
46	CITY OF CLEVELAND (O) CITY OF CLEVELAND, DEPARTMENT OF PUBLIC SAFETY, FIRE DEPARTMENT (L)
47	SCRANTON-AVERELL, INC. (O) G&W INDUSTRIES, INC (L)
48	ALPERT BROS. LEASING CO (O) G&W INDUSTRIES, INC (L)
49	ALPERT BROS. LEASING CO (O) ALPHA PRECAST CORP (L)
50	BALTIMORE AND OHIO RAILROAD CO. (O) G&W INDUSTRIES, INC (L)
51	BALTIMORE AND OHIO RAILROAD CO
52	UNITED STATES STEEL CORP
53	MURON CEMENT, DIVISION OF NATIONAL GYPSUM CO.
54	ONTARIO STONE CORP.
55	THE FOREST CITY PUBLISHING CO. (O) GREAT LAKES TOWING CO (L)
56	THE FOREST CITY PUBLISHING CO (O) G&W INDUSTRIES, INC (L)
57	DUNBAR & SULLIVAN DREDGING CO
58	INTERNATIONAL SALT CO
59	ASHLAND PETROLEUM CO
60	SAND PRODUCTS CORP (O) BRIAN D. STICKNEY, CONTRACTOR (L)
61	ONTARIO STONE CORP
62	ONTARIO STONE CORP.
63	CITY OF CLEVELAND (O) CITY OF CLEVELAND, DEPARTMENT OF PUBLIC UTILITIES, DIVISION OF WATER (L)
64	CONSOLIDATED RAIL CORP. (O) GREAT LAKES DREDGE AND DOCK CO (L)
65	CONSOLIDATED RAIL CORP (O) OHIO AND WESTERN PENNSYLVANIA DOCK CO. (L)



IS CUYAHOGA RIVER SECTION
Outer Harbor section see Map 6)

AREAS PARTIALLY DREDGED

UYAHOGA RIVER PARTIALLY DREDGED TO 23.0 FEET
PSTREAM OF BRIDGE NO. 1 TO JUNCTION WITH OLD
VER

LD RIVER PARTIALLY DREDGED TO 23.0 FEET FROM
NCTION WITH CUYAHOGA RIVER TO OPPOSITE SAND
ODUCTS CORP. DOCK, REMAINDER DREDGED TO
0 FEET

CLEVELAND HARBOR
OHIO

SCALE OF FEET
1000 0 1000 2000

U.S. ARMY ENGINEER DISTRICT BUFFALO
30 SEPTEMBER 1982

FIGURE

The Cleveland Lakefront Harbor extends for a distance of about 5 miles along the shoreline and varies in width from about 1,600 to 2,400 feet. Entrance into the Lakefront Harbor is provided through either the dredged channel between the arrowhead breakwaters (main or west entrance) or between the easterly end of the east breakwater and the shore (east entrance). The Cleveland Inner Harbor includes improved navigation channels on the lower 5.8 miles of the Cuyahoga River and about 1 mile of the Old River, the former outlet of the Cuyahoga River. Widths in the navigation channels vary from 100 to 325 feet, except at the bends and in the existing turning basin in the Cuyahoga River where a width of 800 feet is available.

The Corps of Engineers is responsible for maintaining the breakwaters and piers and for dredging the river channels and Lakefront Harbor to authorized depths. In addition, since the dredged material is classified as polluted and unacceptable for open-lake disposal, the Corps of Engineers has also constructed diked disposal areas to contain this material.

STUDY AREA

The study area extends from the Lake-Cuyahoga County Line on the east to the Rocky River on the west, a total shoreline distance of about 21 miles. The overall study area was selected such that it extended beyond the influence of the harbor, with convenient termination boundaries. The total area was further subdivided into 14 reaches along natural boundaries, with geologic similarities, to facilitate the study and for comparative purposes (see Figure 5).

TERMINATION REPORT ORGANIZATION

This Termination Report is organized into the following sections:

Main Report - Summary of technical data, plan development and evaluation, plan comparison, and recommendations.

Appendix A - Coastal Evaluation of Shoreline Erosion and Federal Impacts

Appendix B - Coastal Engineering Investigations and Designs

Appendix C - Economics

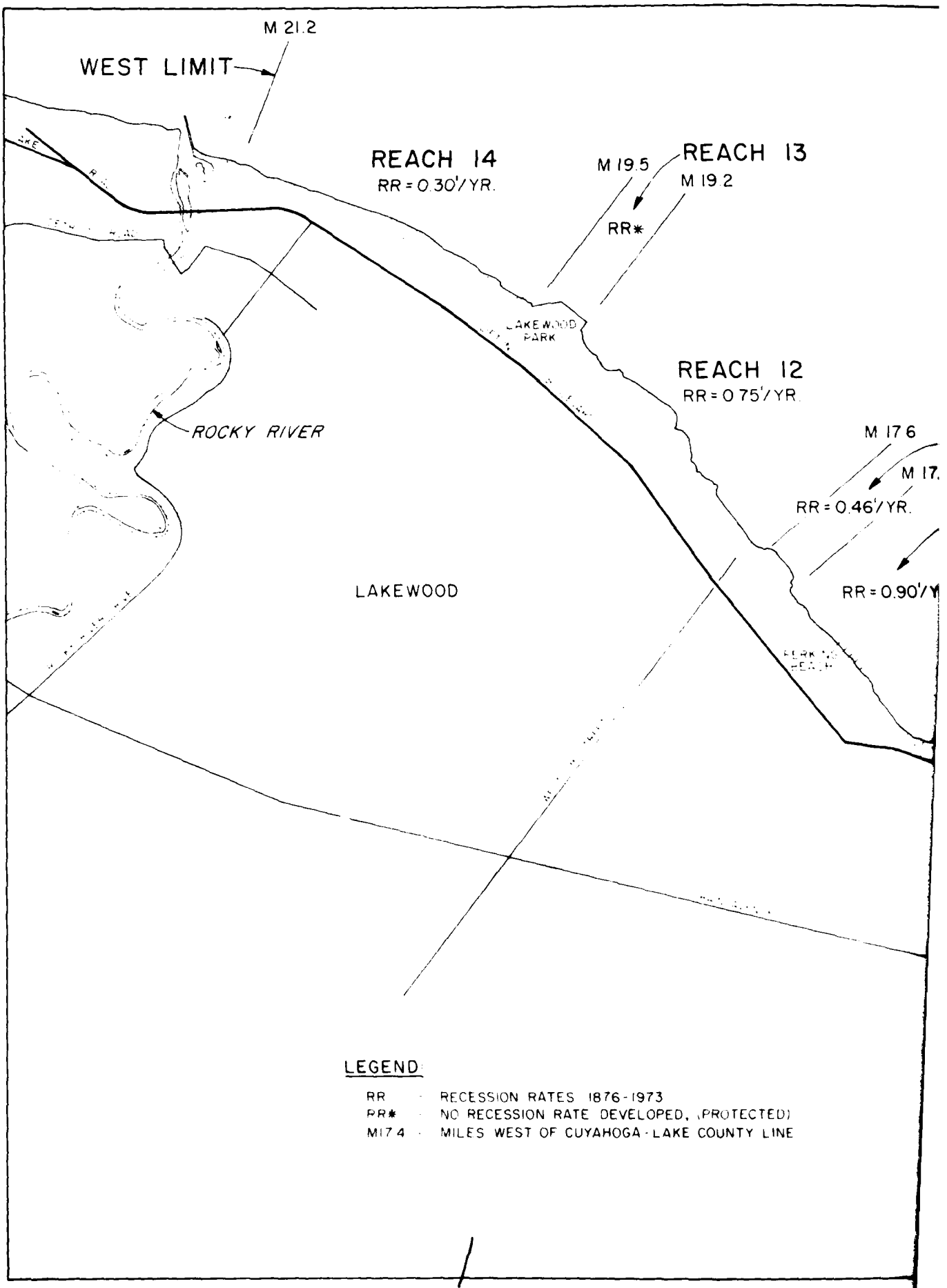
Appendix D - Summary of Environmental Considerations

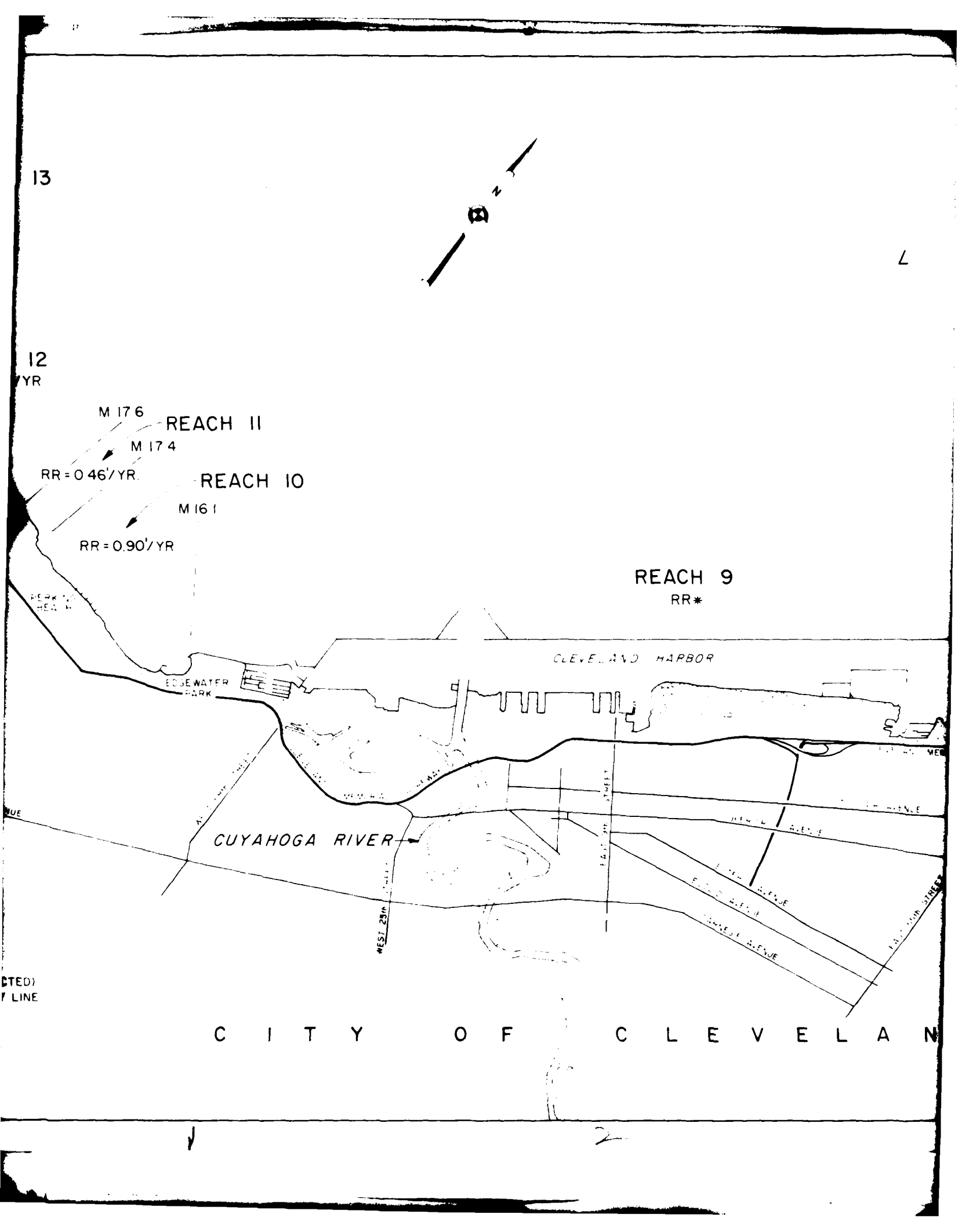
Appendix E - Cost Estimates

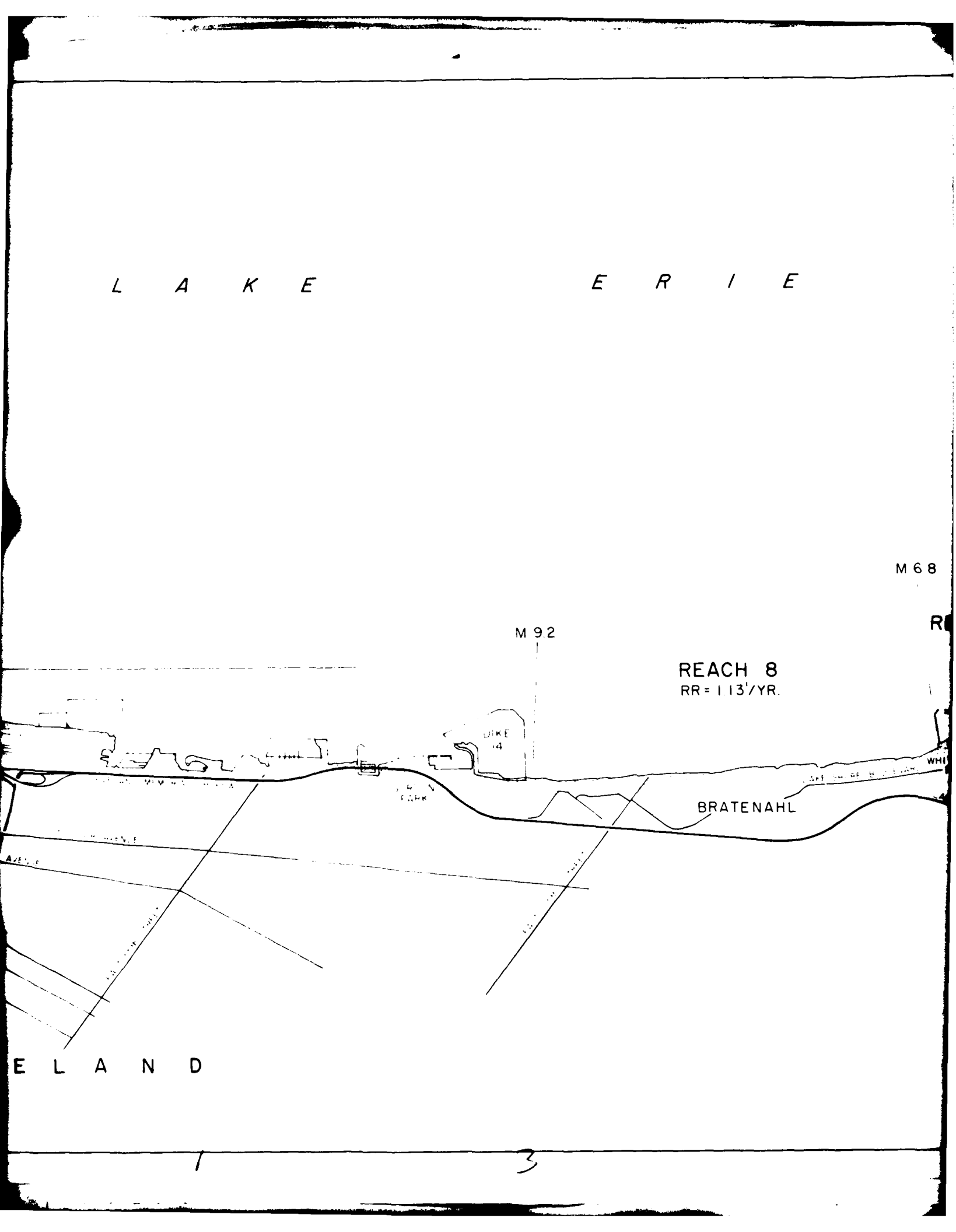
PLANNING OBJECTIVES

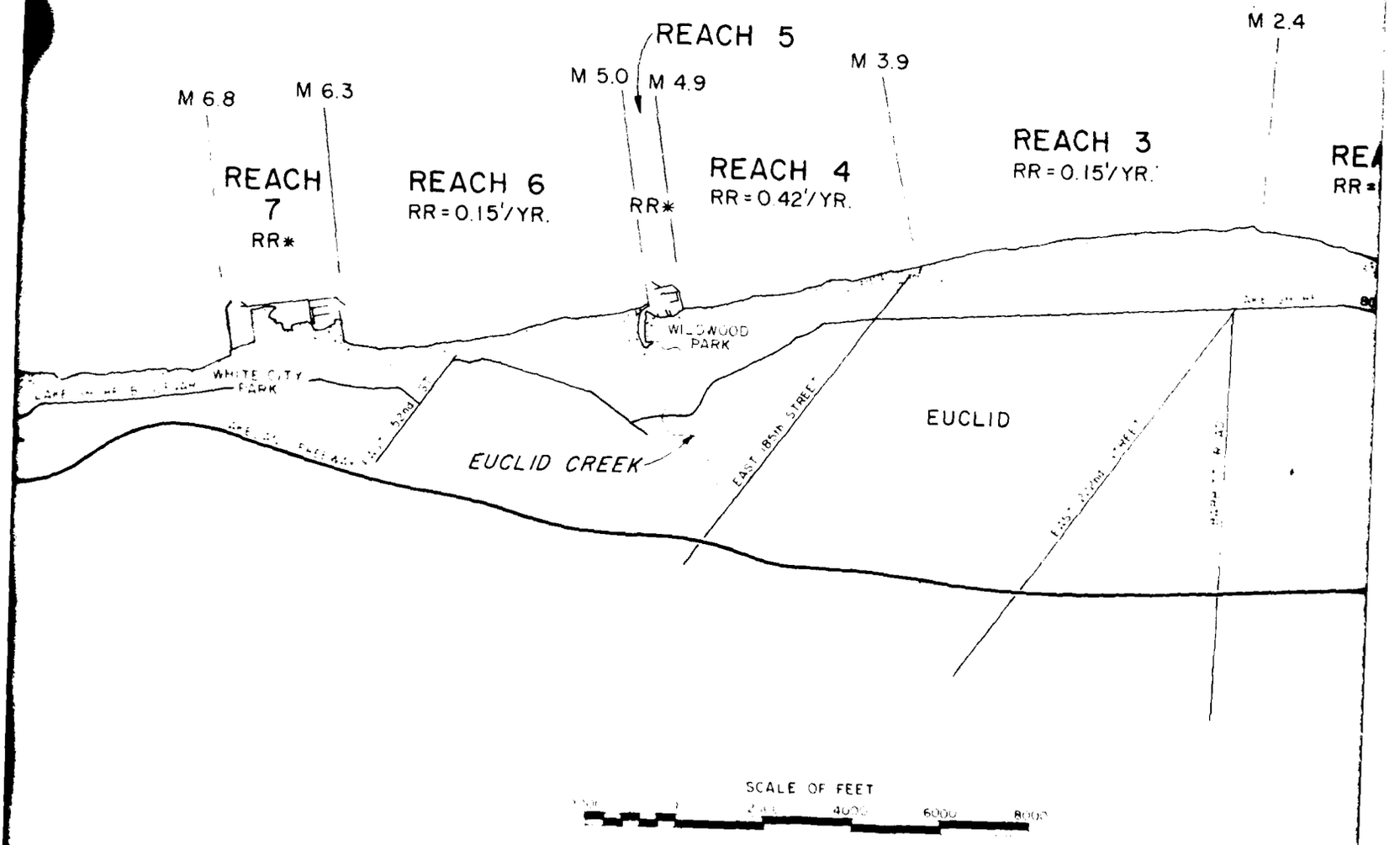
There are three planning objectives which were addressed in this study:

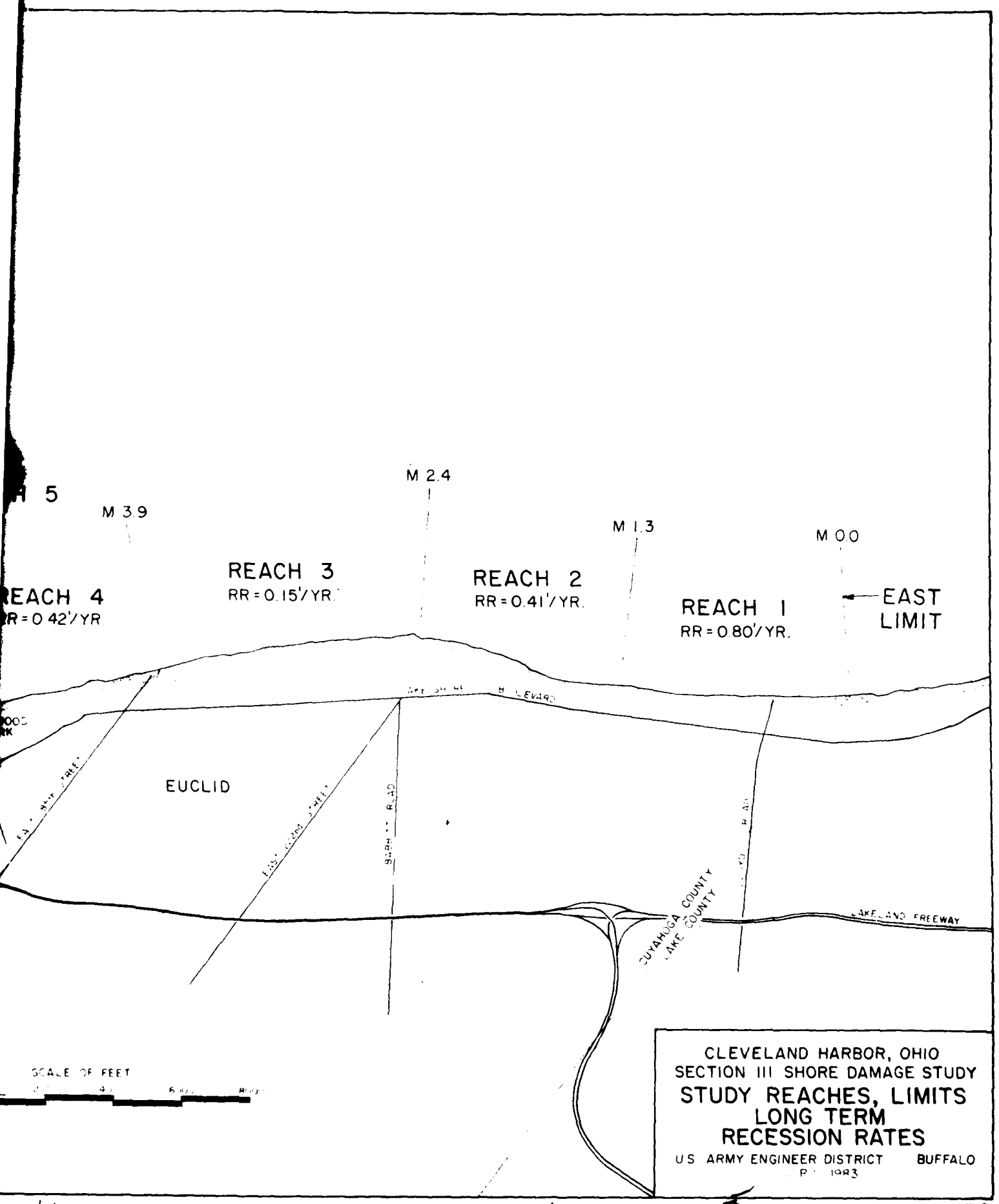
a. Improvement of National Economic Development by increasing the value of the nation's output of goods and services and improving economic efficiency;


M 21.2
WEST LIMIT
REACH 14
RR = 0.30'/YR.
M 19.5
M 19.2
REACH 13
RR*
LAKEWOOD PARK
REACH 12
RR = 0.75'/YR.
ROCKY RIVER
M 17.6
RR = 0.46'/YR.
RR = 0.90'/Y
LAKEWOOD
LEGEND
RR - RECESSION RATES 1876-1973
RR* - NO RECESSION RATE DEVELOPED, (PROTECTED)
M17.4 - MILES WEST OF CUYAHOGA-LAKE COUNTY LINE


13
12
YR
M 17 6
REACH 11
M 17 4
RR = 0.46'/YR.
REACH 10
M 16 1
RR = 0.90'/YR
REACH 9
RR*
CLEVELAND HARBOR
EDGEWATER PARK
CUYAHOGA RIVER
WEST 25TH STREET
EAST 9TH STREET
CTED)
LINE
C I T Y O F C L E V E L A N


L A K E
E R I E
M 6 8
M 9.2
REACH 8
RR = 1.13'/YR.
DIKE
14
BRATENAHL
E L A N D


M 6.8
M 6.3
M 5.0
M 4.9
M 3.9
M 2.4
REACH 7
RR*
REACH 6
RR = 0.15'/YR.
RR*
REACH 5
REACH 4
RR = 0.42'/YR.
REACH 3
RR = 0.15'/YR.
WILDWOOD PARK
WHITE CITY PARK
EUCLID CREEK
EUCLID
EAST 185th STREET
SCALE OF FEET
4000
6000
8000



CLEVELAND HARBOR, OHIO
SECTION III SHORE DAMAGE STUDY
STUDY REACHES, LIMITS
LONG TERM
RECESSION RATES
U.S. ARMY ENGINEER DISTRICT BUFFALO
1983

FIGURE 5

b. Enhancement of Environmental Quality by the management, conservation, preservation, creation, restoration, or improvement of the quality of certain natural and cultural resources and ecological systems;

c. Mitigation or prevention of shore damages due to the Cleveland Harbor Navigation works.

RECESSION RATES

a. General.

Table 1 provides a summary of recession rates which were developed in the Coastal Appendix A for each of the 14 reaches within the study area, with each reach further subdivided into 1,000-foot segments. Recession rates were developed for three different periods, 1876-1937, 1937-1973, and combined for 1876-1973. These recession rates were based upon recession data developed by the Ohio Department of Natural Resources (ODNR).

Of the 14 reaches for which erosion rates were developed, Reaches 8 (Bratenahl) and 10 (Perkins Beach), have the highest long-term recession rates (1876-1973), i.e., 1.13 feet/year and 0.90 feet/year, respectively. Recession along these two reaches is most suspect and likely to be impacted by the Federal harbor, because of their position adjacent to the harbor (see Figure 5).

Reaches 1 and 12 also have significant long-term recession rates (1876-1973) of 0.80 and 0.75 feet/year, respectively. However, both reaches are a considerable distance from the harbor and are semi-isolated from the Federal harbor by natural and man-made protuberances. The other reaches within the study area have long-term erosion rates which are minimal, less than 0.5 feet/year, and were not considered for mitigative action under this study. Other detailed rationale for elimination of reaches other than Reach 8 and Reach 10 is provided in the Coastal Appendix A.

Since Reaches 8 and 10 have been under the influence of Cleveland Harbor for the entire evaluation period of 1876-1973, Reach 1, at the east limit of the study area, was selected as representative of an area of natural recession (i.e., an area not affected by the harbor project) which is most similar in geology and orientation to Reaches 8 and 10 for comparison purposes. It is beyond the influence of the harbor structures, has few private protection works, is in the same general area, and has generally not been influenced by man and his developments. For use in comparing Reach 8, the period of 1876-1938 is chosen as one which provides the most representative, long-term, average recession rate. The corresponding natural recession rate during this period for Reach 1 is about 1.0 feet/year. Extensive landfill operations in Reach 8 after this period preclude the use of later data on recession rates. For the Perkins Beach area - Reach 10, the period of 1876-1973 is chosen. It is the longest period for which data is available, and thus best representative of a natural recession rate, which is 0.8 feet/year along Reach 1.

b. Reach 8, Bratenahl.

As can be determined from Table 1, the easterly 3,500 feet of the Bratenahl shoreline averaged about 2.8 feet/year recession for the period 1876-1938, while the remaining 9,500 feet of shoreline averaged 1.1 feet/year recession over the same period. After this period, extensive landfill operations occurred randomly over this reach of shoreline making use of the data, for the 1938-1973 and the 1876-1973 periods, meaningless.

There is a logical explanation for the higher recession rate of 2.8 feet/year over the east 3,500 feet of shoreline. A sediment trap existed at the east end of the reach in the form of the White City Park Sewage Treatment Plant since 1933 and a breakwater prior to this date (see Figure 6). Littoral material, moving alongshore towards the east, became trapped behind these structures and was no longer available for alongshore transport and beach nourishment. This not only adversely affected beaches to the east, but also caused starvation of beaches to the west during periods of wave climate reversal. Calculations show that during the 36-year period, 1933-1968, approximately 41,778 cubic yards of material were trapped by the White City Sewage Treatment Plant, or about 1,160 cubic yards/year. Prior to 1933, the breakwater at this location had a similar influence on the shoreline recession rate. In 1968, this trap was sealed by a steel sheet pile wall which connected the formerly detached West Breakwater to shore, as shown on Figure 5. Although the sheet pile wall still traps littoral material moving from west to east, this material is exposed to the wave climate and is available for transport to the west during periods of wave climate reversal. Thus, its impact to the Bratenahl area is reduced.

The previous discussion indicates that the White City structures were a direct cause of the higher erosion rate of the east 3,500-foot of shoreline, i.e., 2.8 feet/year versus 1.1 feet for the westerly remainder. If the difference of 1.7 feet/year recession were related to a quantity of littoral material lost from the bluff (3,500 feet X 1.7 feet/year X 25 feet high bluff X 22 percent of bluff material is sand) the resultant quantity equals 1,212 cubic yards/year. This 1,212 cubic yards closely approximates the calculated value of 1,160 cubic yards trapped by the White City structures and it is, therefore, concluded that 1.7 feet of erosion over the eastern portion of the reach is attributable to the White City structures. Therefore, reducing the total recession rate of 2.8 feet/year for the eastern 3,500 feet by the 1.7 feet leaves 1.1 feet of recession per year. Further reducing this value by the 1.0 feet/year of natural recession from Reach 1 leaves 0.1 feet/year which is nonexplainable and therefore assumed to be induced by the Federal Harbor project.

The remaining 9,500 feet of Bratenahl shoreline to the west averages 1.1 feet of recession per year. Reducing this amount by the 1.0 feet/year recession as was done for the remainder of the reach leaves a value of 0.1 feet/year as a Federal responsibility for this section also.

Table 1 - Summary of Recession Rates

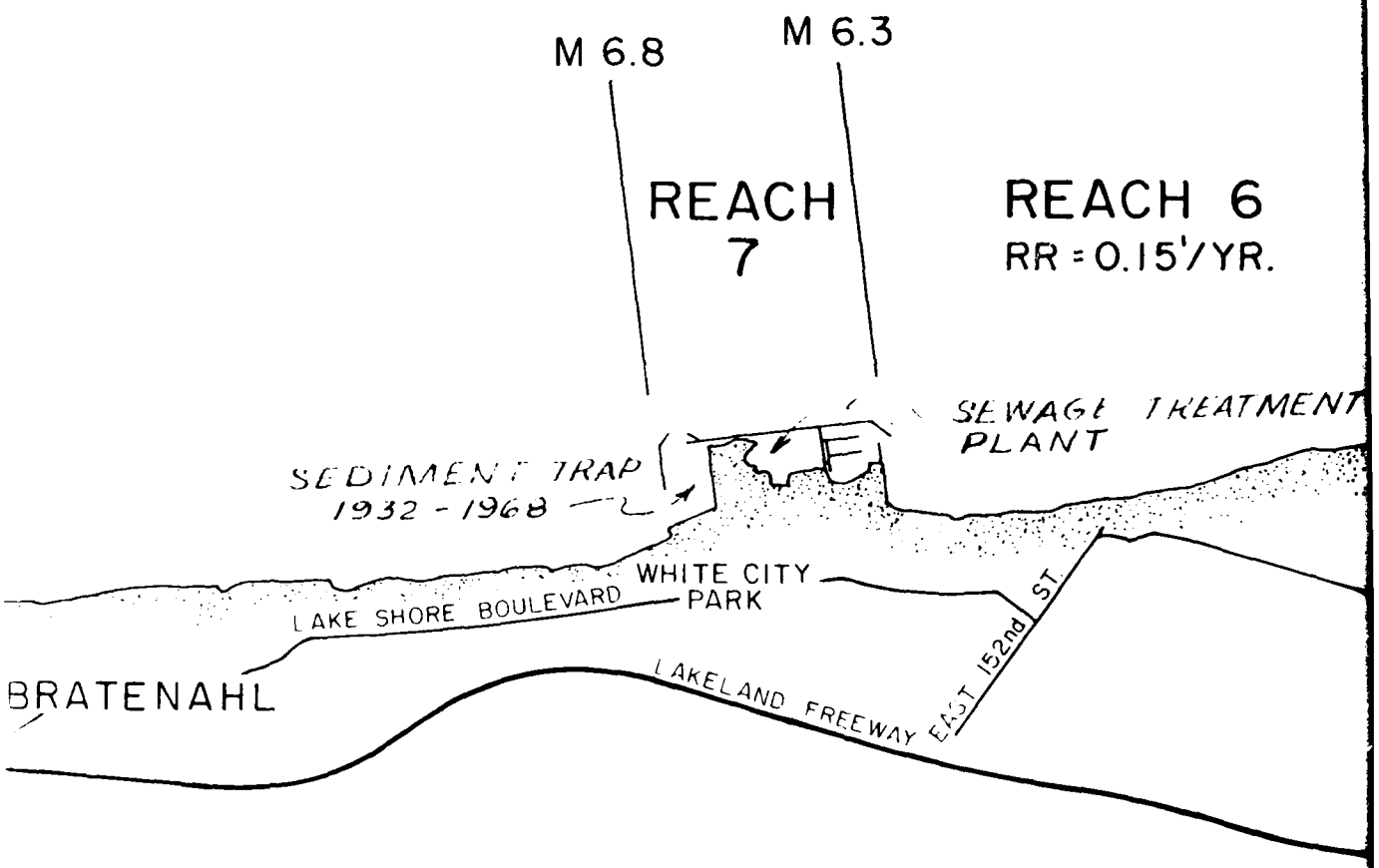
Reach	Length	Profile (ft)	(61 Years) 1876-1937 Recession (ft)	Rate	(36 Years) 1937-1973 Recession (ft)	Rate	(97 Years) 1876-1973 Recession (ft)	Rate	Reach Identifier
1	7,000	0	40	.66	100	2.78	140	1.44	
		1,000	115	1.89	-	-	115	1.19	
		2,000	65	1.07	-	-	65	.67	
		3,000	70	1.15	15	.42	95	.98	
		4,000	80	1.31	-	-	80	.82	
		5,000	30	.49	20	.56	50	.52	
		6,000	25	.41	-	-	25	.26	
		7,000	50	.82	-	-	50	.52	
			Average =	.98	=	.47	=	.80	
2	6,200	0	50	.82	-	-	50	.52	
		1,000	-	-	-	-	-	-	
		2,000	90	1.23	40	-	45	.46	
		3,000	25	.41	-	-	25	.26	
		4,000	45	.74	20	.56	65	.67	
		5,000	55	.90	-	-	55	.57	
		6,000	30	.49	51	.14	35	.36	
			Average =	.66	=	.10	=	.41	
			(62 Years) 1876-1938		(35 Years) 1938-1973				
3	7,900	0	40	.65	-	-	40	.41	
		1,000	30	.48	-	-	30	.31	
		2,000	-	-	-	-	-	-	
		3,000	5	.08	-	-	5	.05	
		4,000	-	-	-	-	-	-	
		5,000	-	-	-	-	-	-	
		6,000	10	.16	-	-	10	.10	
		7,000	30	.48	-	-	30	.31	
			Average =	.23	=	0	=	.15	
4	5,280	0	-	-	-	-	-	-	
		1,000	-	-	20	.57	20	.21	
		2,000	-	-	-	-	-	-	
		3,000	45	.78	-	-	45	.46	
		4,000	45	.73	45	1.29	90	.93	
		5,000	10	.16	80	2.29	90	.93	
			Average =	.27	=	.69	=	.42	

Table 1 - Summary of Recession Rates (Cont'd)

Reach	Length	Profile (ft)	(62 Years) 1876-1938 Recession (ft)	Rate	(35 Years) 1938-1973 Recession (ft)	Rate	(97 Years) 1876-1973 Recession (ft)	Rate	Reach Identifier
5	1,100	Protected Section, Flood Plain							Wildwood
6	6,500	0	15	.08	-	-	5	.05	
		1,000	15	.24	-	-	15	.15	
		2,000	35	.56	-	-	35	.36	
		3,000	-	-	-	-	-	-	
		4,000	30	.48	-	-	30	.31	
		5,000	15	.24	-	-	15	.15	
		6,000	-	-	-	-	-	-	
			Average = .23		= 0		= .15		
7	2,600	Protected, Shore Modified							White City
8	13,000	0	180	2.90	-	-	180	1.86	Bratenahl
		1,000	175	2.82	-	-	175	1.80	
		2,000	175	2.82	-	-	175	1.80	
		3,000	175	2.82	-	-	175	1.80	
		4,000	40	.65	-	-	40	.41	
		5,000	35	.56	-	-	35	.36	
		6,000	75	1.21	-	-	75	.77	
		7,000	30	.48	-	-	30	.31	
		8,000	115	1.85	-	-	115	1.19	
		9,000	75	1.21	-	-	75	.77	
		10,000	165	2.66	25	.71	190	1.96	
		11,000	95	1.53	5	.14	100	1.03	
		12,000	30	.48	35	1.0	65	.67	
		13,000	30	.48	70	2.0	100	1.03	
			Average =1.61		=0.28		=1.13		
9	32,600	Protected, Shore Modified							Cleveland
10	7,000	0	20	.32	35	1.0	60	.62	
		1,000	65	1.05	-	-	65	.67	
		2,000	45	.73	15	.43	60	.62	
		3,000	45	.73	40	1.14	85	.88	
		4,000	80	1.29	25	.71	105	1.08	Perkins
		5,000	140	2.26	45	1.29	185	1.91	Beach Area
		6,000	80	1.29	20	.57	100	1.03	
		7,000	25	.40	15	.43	40	.41	
			Average =1.01		= .70		= .90		

Table 1 - Summary of Recession Rates (Cont'd)

Reach	Length	Profile	(62 Years) 1876-1938 Recession (ft)	Rate	(35 Years) 1938-1973 Recession (ft)	Rate	(97 Years) 1876-1973 Recession (ft)	Rate	Reach Identifier
11	1,000	250	65	1.05	25	.71	90	.93	
		750	-	--	-	--	-	--	
			Average = .52			= .36		= .46	Bramley Estate
12	8,700	500	65	1.05	25	.71	90	.93	
		1,500	25	.40	15	.43	40	.41	
		2,500	20	.32	-	--	20	.21	
		3,500	40	.65	-	--	40	.41	
		4,500	65	1.05	20	.57	85	.88	
		5,500	75	1.21	-	--	75	.77	
		6,500	80	1.29	35	1.0	115	1.19	
		7,500	75	1.21	25	.71	100	1.03	
		8,500	55	.89	30	.86	85	.88	
			Average = .90			= .48		= .75	
13	1,400	Protected, Shore Modified							
14	9,300	0	40	.65	25	.71	65	.67	
		1,000	40	.65	-	--	40	.41	
		2,000	45	.73	-	--	45	.46	
		3,000	25	.40	-	--	25	.26	
		4,000	25	.40	-	--	25	.26	
		5,000	-	--	-	--	-	--	
		6,000	15	.24	15	.43	15	.15	
		7,000	20	.32	20	.57	40	.41	
		8,000	15	.24	-		15	.15	
		9,000	20	.32	-	--	20	.21	
			Average = .40			= .17		= .30	



SEDIMENT TRAP
WHITE CITY SEWAGE
TREATMENT PLANT
CLEVELAND, OHIO

FIGURE 6

c. Reach 10, Perkins Beach.

Of the total 1.3 miles in Reach 10, only the 0.4-mile section shown on Figure 7 is considered to have serious erosion, and is called the Perkins Beach area. This portion of Reach 10 is that under consideration for the remainder of this Section 111 study.

A permeable groin system was built in the 1940's, and has been partially successful in reducing recession from an average of 1.6-foot/year in 1876-1938 to 0.9-foot/year in 1938-1973. This equates to an average long-term recession rate (over the period of 1876-1973 for this 2,000+ foot section) of 1.3 feet/year. Comparing this rate to the natural rate of 0.8 feet/year indicates that the difference of 0.5 feet/year can be attributed to the harbor structures.

FEDERAL RESPONSIBILITY

The Reconnaissance Report completed in March 1977 concluded that . . . "It is considered impossible to evaluate damages due to the effect of Cleveland Harbor or the benefits from the proposed mitigation . . ." The harbor itself has been constructed and modified over a lengthy period dating back to the year 1825 when jetties were first added to the Cuyahoga River. Information which would provide shoreline position and recession rates is nonexistent or unusable prior to the 1900's. In addition, the numerous private shore protection works and artificial filling operations prohibit isolation of a natural recession rate from the Federal impact. Thus, recession rates were developed and compared over long periods of time in an attempt to average out temporal effects.

a. Possible Federal Causes of Erosion.

An analysis was performed wherein each of the possible Federal causes of erosion were identified and evaluated. The possible causes are as follows:

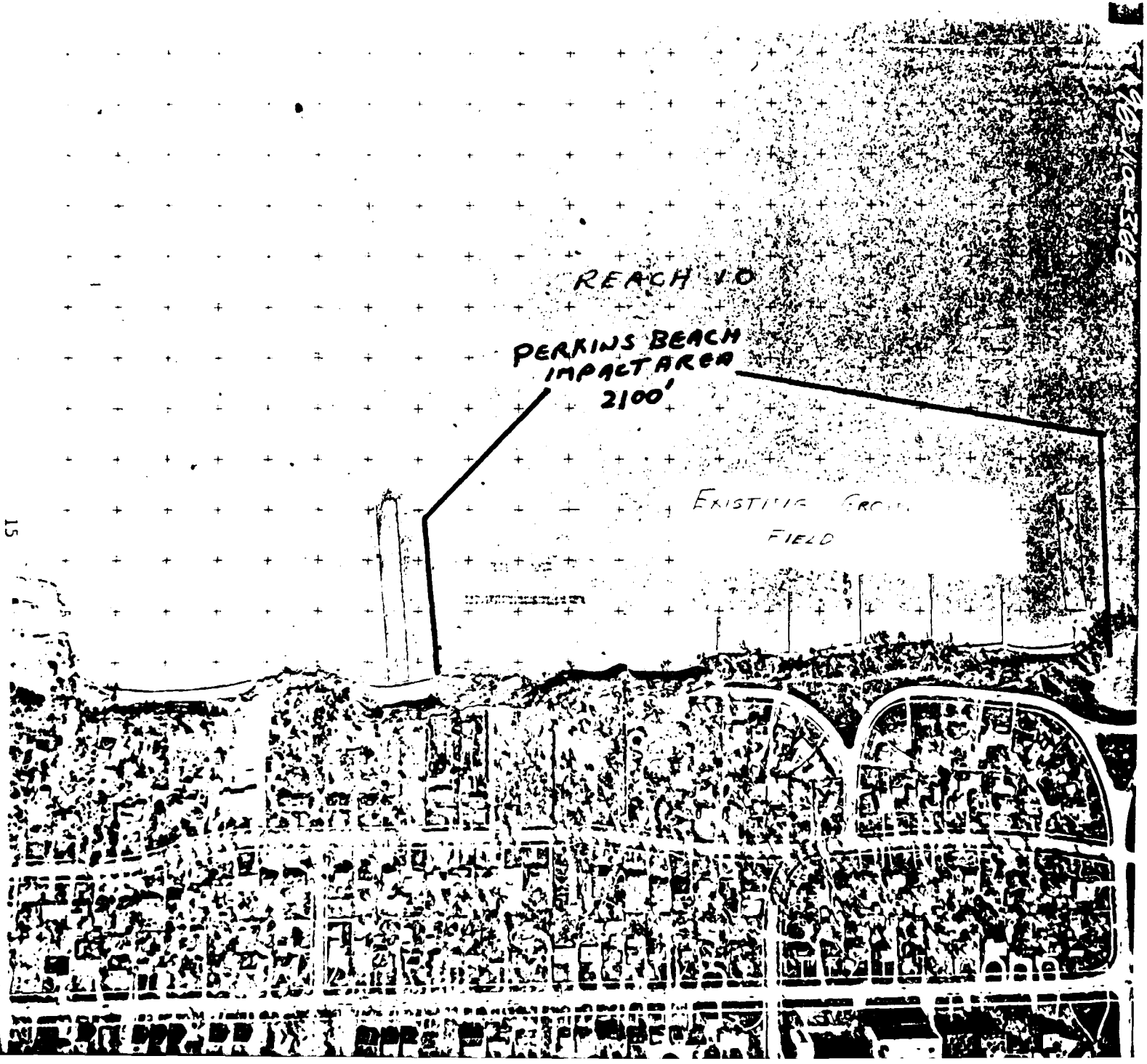
(1) Interruption of alongshore moving sediment by the trapping effect of the Cleveland Harbor breakwater system, thereby depriving downdrift shores of their normal sediment supply.

(2) The Cleveland Harbor breakwater system could trap material at the open east end during periods of east to west transport permanently removing sand from the littoral system.

(3) The Cleveland Harbor breakwater system could reduce the quantity of material available to the system by sheltering over 5 miles of bluff face from recession, thus removing a potential source of littoral material.

(4) The Cleveland Harbor structures could modify the local wave climate via reflection or diffraction to cause wave energy concentration or generate current pattern constrictions which affect a very localized reach of shoreline.

(5) The annual dredging of the Cuyahoga River and disposal of this material lakeward of the harbor breakwaters or in confined diked disposal



IMPACT AREA
REACH 10
PERKINS BEACH

FIGURE 7

sites has permanently removed a quantity of sand-sized material from the littoral systems.

Of the five potential modes by which the Federal Harbor Project could have an adverse impact on adjacent shores, only (5), annual dredging of the Cuyahoga River was determined to have had an adverse impact on adjacent shores.

Rationale for elimination of the other possible causes is provided in the text of the Coastal Evaluation Appendix A.

Annual dredging of the Cuyahoga River and disposal of this material offshore or in a confined dike results in permanent removal of this material from the littoral system. An analysis was performed to determine quantities of material denied to the system by this dredging and the impact that this removal has had on the two areas (Reaches 8 and 10) under consideration.

b. Littoral Transport Quantities.

Routine annual dredging of the Cuyahoga River to maintain satisfactory navigation depths removes a volume of sand-sized material from the system that would otherwise be available to feed shoreline areas. Calculations performed based on surveys and sampling (see Coastal Evaluation Appendix A) indicates that somewhere in the range of 38,000 to 48,000 cubic yards of sand-sized material is denied to the system annually by dredging. A figure of 45,000 cubic yards/year was selected as the average annual fluvial yield of potential littoral material which would be available to the littoral system without dredging.

Of the 45,000 cubic yards of sand-sized material calculated as available to feed the littoral system without dredging, it is assumed that 20 percent (9,000 cubic yards) would be lost offshore, and 56 percent and 44 percent of the remainder would be distributed east and west respectively along the shoreline. (Calculation of these percentages was performed based upon acceptable methods outlined in the Shore Protection Manual). Application of these percentages to the 45,000 cubic yards/year of sand-sized material gives values of 20,160 cubic yards/year to the east and 15,840 cubic yards/year of sand sized material to the west. These amounts represent quantities of material denied to the system by dredging.

Distribution of the calculated quantities of sand-sized material (20,160 cubic yards) over the 7.6 miles of easterly shore from the mouth of the Cuyahoga River to White City Park/105th Street Sewage Treatment Plant, gives a uniform rate of 0.5 cubic yards per foot of affected shoreline to the east. On this basis, the estimated loss of beach building material in the 12,600 feet of shoreline in Reach 8 due to dredging of the Cuyahoga River is 6,300 cubic yards/year. Similarly, distributing 15,840 cubic yards over the 3.0 miles of shore west of the Cuyahoga River to Bramley Beach gives a value of 1.0 cubic yard per foot of shoreline west of the harbor. As stated previously, only 0.4 miles of shoreline in Reach 10 is considered to be eroding at a significant rate. For this 0.4-mile section of Reach 10, the estimated loss due to dredging of the Cuyahoga River is about 2,100 cubic yards/year.

FORMULATION OF PRELIMINARY PLANS

Based on the conclusion that the only study reaches that warrant consideration under Section 111 are Reach 8 (12,600 feet) and 0.4 miles in Reach 10 (Perkins Beach), alternative plans were formulated for these two reaches only.

The alternatives considered were designed to mitigate some or all of the current rate of erosion. Under the Section 111 Authority, the Federal responsibility is limited to the least costly alternative which would mitigate all of the Federally induced damages determined to be caused by the construction and subsequent maintenance of the harbor. Thus, a dollar limit of participation is derived based upon the cost of the alternative which can reasonably be expected to mitigate all of the Federally induced erosion.

Cost estimates for the considered alternatives were prepared based on July 1982 price levels, and are included in Appendix E. These costs were annualized based upon a 50-year economic life and 7-5/8 percent interest rate in effect for Fiscal Year 1982.

Project benefits were derived from mitigation of erosion and associated reduction in land losses and damages to associated roads and structures. Damages are determined based upon erosion rates developed in the Coastal Evaluation Appendix A by applying current market values to the land and structures which would be lost without a project and reducing these amounts by damages which would exist with the project.

ALTERNATIVE PLANS CONSIDERED

A range of alternatives were considered for mitigation of damages in Reaches 8 and 10 due to navigation works at Cleveland Harbor. Some of the alternatives would mitigate erosion from all causes while others would mitigate some portion or all of the total erosion. The No-Action plan would not eliminate any damages, but it is used as a base case for comparative purposes, and would be the plan recommended if no other can be implemented.

The alternatives considered for this study are the following:

No-Action

Offshore Breakwaters

Offshore Disposal of Dredged Sand

Feeder Beach - Beachfill

Revetment

Groins

Of the six alternatives considered, the Groin Field and Offshore Breakwaters were eliminated based on the District's experience with similar types of

structures. Studies have shown that a groin field does not have a high degree of certainty in preventing erosion, being dependent upon a strong littoral movement and sufficiency of beach building material. Offshore breakwaters would stop a large percentage of total erosion but the construction cost can only be justified if recreational beach benefits are available.

The remaining four alternatives were evaluated for the two reaches under consideration, i.e., Reach 8 - Bratenahl, and a portion of Reach 10 - Perkins Beach. Further discussions will refer to the Alternatives as follows:

Alternative	Plan	Place
IA	No-Action	Bratenahl
IB	No-Action	Perkins Beach
IIA	Offshore Disposal Dredged Sand	Bratenahl
IIB	Offshore Disposal Dredged Sand	Perkins Beach
IIIA	Feeder Beach-Beachfill	Bratenahl
IIIB	Feeder Beach-Beachfill	Perkins Beach
IVA	Revetment	Bratenahl
IVB	Revetment	Perkins Beach

PLAN DESCRIPTIONS

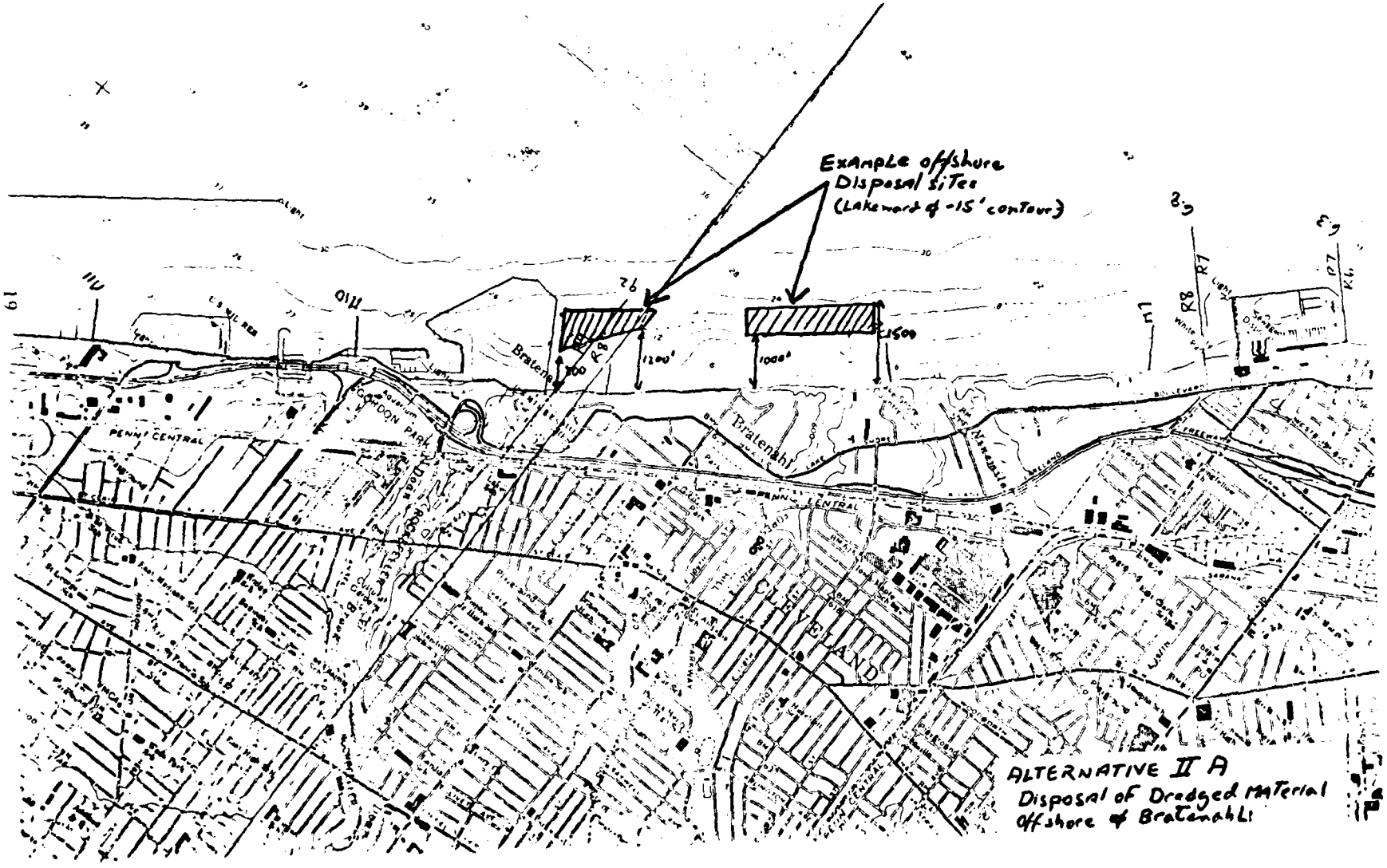
a. Alternatives IA (Reach 8) and IB (Reach 10) - No Action.

This plan is the result if no other plan is implemented. There are no costs or benefits associated with it, nor does it do anything in addressing the planning objectives. It is presented here for comparative purposes.

b. Alternative IIA (Reach 8, Bratenahl) - Offshore Disposal of Dredged Material.

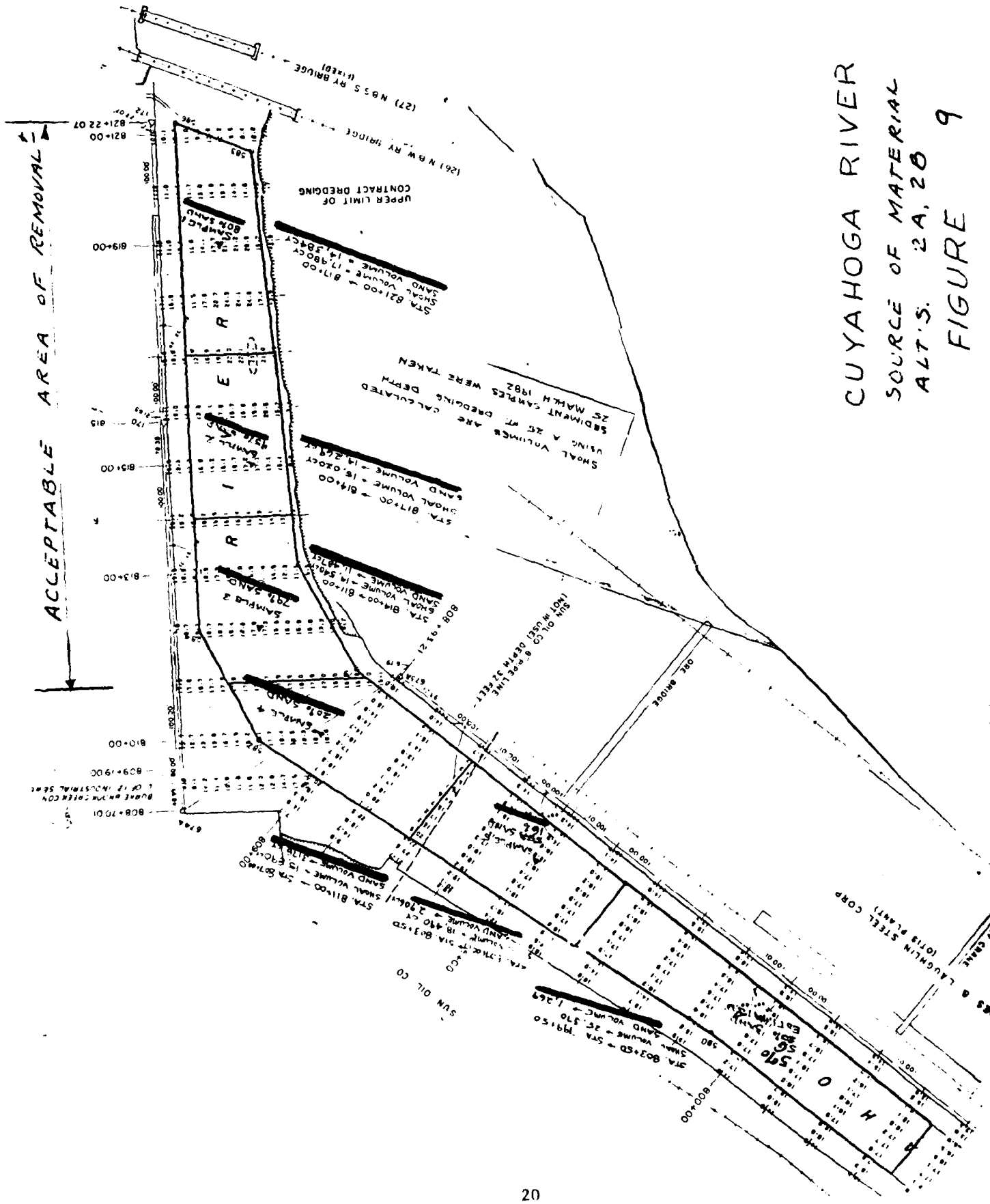
(1) Plan Description - This plan consists of disposal of sand-sized material dredged from the Cuyahoga River, offshore of Bratenahl at the two locations shown on Figure 8.

Samples of dredged material were taken in the spring of 1982 from the Cuyahoga River navigation channel between river stations 805+0 and 821+0. Gradation tests performed on the material indicated that this is an area consisting of predominately fine-grained sand. Chemical testing was performed on the samples to determine if the material is environmentally acceptable for open-lake disposal. Preliminary indications are that there is a 1,000-foot stretch of the Cuyahoga River (see Figure 9) from which environmentally acceptable material may be obtained. The Environmental Protection Agency



ALTERNATIVE II A
Disposal of Dredged Material
Offshore of Bratenahl

FIGURE
8


CUYAHOGA RIVER
SOURCE OF MATERIAL
ALT'S. 2A, 2B
FIGURE 9
ACCEPTABLE AREA OF REMOVAL
UPPER LIMIT OF CONTRACT DREDGING
SHOAL VOLUMES ARE CALCULATED USING A 25' FT DREDGING DEPTH
SEDIMENT SAMPLES WERE TAKEN 25 MARCH 1982
CHANNEL
SUN OIL CO 8" PIPE LINE (NOT IN USE) DEPTH 32 FEET
ONE BRIDGE
LAUGHLIN STEEL CORP (OTIS PLANT)
SUN OIL CO

(EPA) is generally in agreement with the acceptability of the material. See Appendix D for more complete information.

The calculated volume of environmentally acceptable material available from the upper Cuyahoga River is 47,500 cubic yards of sand-sized material, or about 40,000 cubic yards of sand (see Appendix A). Of the total amount of material available for offshore disposal, 35,600 cubic yards of sand-sized material (or, about 30,000 cubic yards of sand) would be placed offshore of Bratenahl in approximately 15 to 18 feet of water. The remaining 11,900 cubic yards of sand-sized material would be placed offshore of Perkins Beach (Alternative IIB). Dividing the available material between these two areas in this manner (i.e., 3:1 ratio) approximates the ratio of estimated loss of sand-sized material to the two affected shoreline areas caused by the Federal harbor project (i.e., 6,300 cubic yards of sand per year at Bratenahl, versus 2,100 cubic yards at Perkins' Beach, or approximately 3:1).

Although it is anticipated that material consisting mainly of sand which is placed in water depths of 15 to 18 feet should enter the nearshore littoral zone, no assurances of this can be made. It was assumed that 20 percent of the total volume placed will reach the nearshore littoral zone. This amount (20 percent X 30,000 cubic yards of sand) equals 6,000 cubic yards per year and is equivalent to the amount calculated to have been denied to the Bratenahl area by the annual harbor dredging (6,300 cubic yards), thereby mitigating all of the Federal responsibility for Reach 8.

(2) Cost and Economic Efficiency of Alternative IIA - Costs for this plan were based on a 1982 spring dredging contract adjusted by elimination of costs associated with disposal in the confined disposal area, Site 14 (i.e., cost of operating the pump-out unit, derrickboat, pipelines, barges and utility boat). On this basis, the actual calculated cost for open-lake disposal of the material at the locations shown in Figure 8 is $4.50 per cubic yard, or $160,200 for the 35,600 cubic yards of sand-sized material required. Since this operation would be performed annually, this is the total average annual cost for Alternative IIA. In addition, this cost is also the limitation of Federal expenditure for all other plans at this site since it is the least cost plan that would mitigate all of the Federal responsibility for erosion.

Benefits for this plan were based on the assumption that all Federally induced erosion damages would be mitigated. Benefit categories consist of (1) land and structures loss prevention and (2) elimination of costs associated with disposal of material dredged from the Cuyahoga River in Disposal Site 14. An average annual reduction in land loss of 0.1 foot per year for the 12,600-foot shoreline of Reach 8 equates to $860 in average annual land and structures loss benefits. An annual cost savings of $220,720 would be realized by eliminating costs normally associated with dredging and disposal in Dike 14, (35,600 cubic yards x $6.20/cubic yard). The total annual benefit is the sum of these benefits or $221,580.

With average annual costs of $160,200 and average annual benefits of $221,580, the net annual benefits are $61,380 and the benefit to cost ratio is 1.4. These results are summarized in Table 2.

(3) Major Environmental Features/Preliminary Assessment of Alternative IIA - Alternative IIA would provide positive environmental benefits by mitigating Federally induced erosion. The use of dredged material for nourishment of the littoral drift system under this alternative would result in the conservation of sand which would otherwise have been discarded in a diked disposal area. The offshore disposal of sand would also be expected to conserve fuel, since less time should be required for operation of the disposal equipment.

This plan would be expected to produce temporary, adverse impacts to water quality, benthic macroinvertebrates, plankton, and fishery resources at the selected disposal site or sites. Temporary, minor air quality impacts would be expected due to emissions produced by the disposal equipment. Based on the sediment test results cited in Appendix D, negligible long-term impacts to water quality and plankton are expected. Although benthic macroinvertebrates would be covered and destroyed during disposal, rapid recolonization of the disposal site(s) would be expected to occur. Since the sediment quality at the disposal sites is presently unknown, it is also not known whether benthic macroinvertebrate species composition might be altered due to disposal. The value of the potential disposal sites as benthic and fishery habitat is presently unknown and would be thoroughly evaluated as appropriate prior to plan implementation.

Table 2 - Summary of Benefits and Cost for Alternative IIA, July 1982 Price Levels

Item	Annual Value
	$
Annual Benefits	
Land Loss Reduction	660
Structures Loss Reduction	200
Dredging & Disposal Costs Avoided	220,720
Total Annual Benefit	221,580
Total Annual Charges	160,200
Net Annual Benefits	61,380
Benefit/Cost Ratio	1.4

Alternative IIA would be expected to mitigate the negative impacts on the human environment that would occur under the base case. Few adverse impacts on the human environment should result due to implementation of this plan. Although an increase in water turbidity may have some minor impacts on sport fishing, these impacts would be of short duration and would cease shortly after the disposal operation was complete. Recreational impacts would potentially be minimized by scheduling disposal to occur during times of low

fishing activities and by implementing other appropriate mitigation measures as discussed in Appendix D. Although some noise would be generated by the disposal equipment, operations would be performed in an area well removed from human activities, causing no significant impacts. No known cultural resources would be adversely affected under this plan.

c. Alternative IIB - Offshore Disposal of Dredged Sand - Reach 10, Perkins Beach.

(1) Plan Description - This plan is similar to Alternative IIA, except that the place of disposal would be offshore of Perkin Beach (Reach 10) at the location shown in Figure 10.

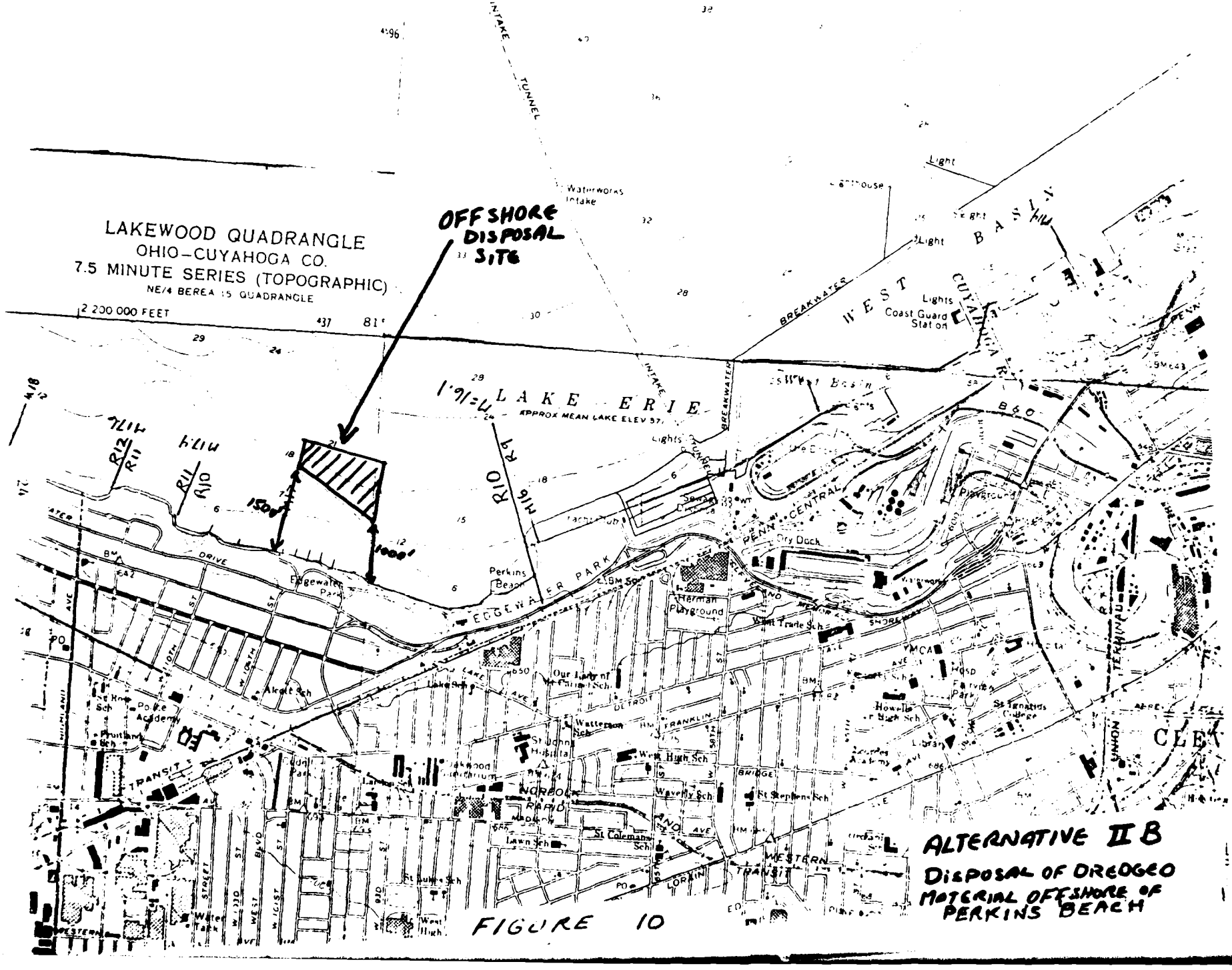
The calculated quantity of material necessary to replace that dredged annually from the Cuyahoga River is approximately 2,000 cubic yards of sand. Assuming a 20 percent effectiveness of material entering the alongshore littoral system it would be necessary to dump 10,000 cubic yards of sand annually.

(2) Cost and Economic Efficiency of Alternative IIB - Costs of this alternative were calculated as in Alternative IIA except as noted. This estimate further reduces the cost of disposal below similar costs for the Bratenahl area by eliminating one of the two tugs and two of the six bottom dump scows for transporting material from the mouth of the river to the disposal site.

Calculated costs for disposal of 11,900 cubic yards of sand-sized material which yields 10,000 cubic yards of sand (84 percent sand as calculated in Appendix B) at Perkins Beach is $3.70 per cubic yard for a total cost of $44,030. This is also the average annual cost since the operation would be performed annually. In addition, this cost is also the limitation of Federal expenditure for all other plans at this site since it is the least cost plan that would mitigate all of the Federal responsibility for erosion.

Benefits associated with Alternative IIB consist of a reduction in land loss of $600 annually and a structural damage reduction of $1,340. There are also normal dredging and confined disposal costs avoided for 11,900 cubic yards of sand-sized material at $6.20 per cubic yard which equals $73,780. The sum of these items gives a total average benefit of $75,720.

With average annual costs of $44,030 and average annual benefits of $75,720 for Plan IIB, the net annual benefits are $31,690 and the benefit to cost ratio equals 1.7. Table 3 summarizes these values.



ALTERNATIVE II B
DISPOSAL OF DREDGED MATERIAL OFFSHORE OF PERKINS BEACH

FIGURE 10

Table 3 - Summary of Benefits and Costs for Alternative IIB
July 1982 Price Levels

Item	Annual Value
	$
Annual Benefits	
Land Loss Reduction	600
Structural Loss Reduction	1,340
Dredging and Disposal Costs Avoided	73,780
Total Annual Benefit	75,720
Total Annual Costs	44,030
Net Annual Benefits	31,690
Benefit/Cost Ratio	1.7

(3) Major Environmental Features/Preliminary Assessment of Alternative IIB - Alternative IIB would produce the same general environmental impacts as discussed under Alternative IIA above, although the impacts under Alternative IIB would occur in the vicinity of the Perkins Beach disposal site, rather than at Bratenahl. Swimming at Lakeshore Park might be temporarily affected during disposal, although recreational impacts could potentially be minimized by appropriate scheduling and by implementing other appropriate mitigation as discussed in Appendix D.

d. Alternative IIIA - Feeder Beach - Reach 8, Bratenahl.

(1) Plan Description - Discussions previously presented showed that dredging of the Cuyahoga River has deprived the Bratenahl shoreline of 6,300 cubic yards of littoral material annually. This alternative plan would mitigate the Federally induced erosion by placing 7,600 cubic yards of sand annually as a feeder beach at the location shown on Figure 11. This 7,600 cubic yards allows for anticipated offshore losses of about 20 percent. The sand would be purchased commercially and trucked to the site where it would be dumped and spread such that it would be accessible to the wave climate. It is not expected that the sand would remain as an observable unit for very long but would quickly be washed alongshore by wave action. Natural erosion would continue and there would be little observable difference in the rate of erosion.

(2) Cost and Economic Efficiency of Alternative IIIA - The estimated first cost (and annual cost since this would be an annual operation) for placement and spreading of 7,600 cubic yards of sand at Bratenahl at the location shown in Figure 11 is $170,000. Federal participation in the cost of this alternative would be limited to $160,200, the average annual cost for Alternative IIA, the least costly plan to mitigate the Federal responsibility

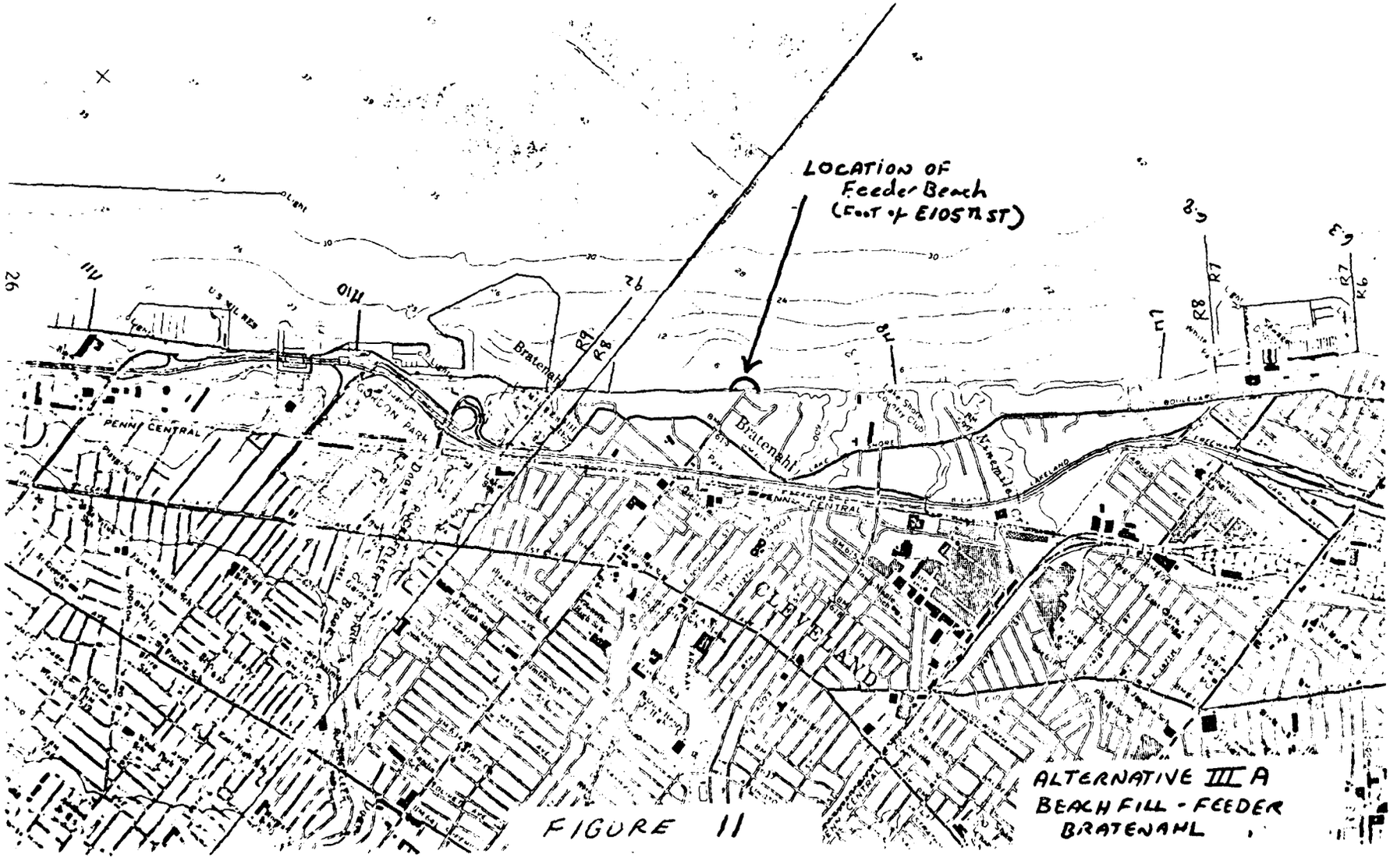


FIGURE 11

ALTERNATIVE III A
BEACH FILL - FEEDER
BRATENAHL

at this site. A local sponsor would be required to pay all costs in excess of this amount, or $9,800 on an annual basis.

The average annual benefits for this alternative are derived from mitigation of 0.1 feet per year of shoreline erosion. The estimated reduction in land loss is $660 per year while the reduction in structural damage is $200, giving a total annual benefit of $860.

With average annual costs of $170,000 and average annual benefits of $860 the annual net benefit equals -$169,140 and the benefit-to-cost ratio equals 0.01. Table 4 summarizes this information.

Table 4 - Summary of Benefits and Cost for Alternative IIIA, July 1982 Price Levels

Item	Annual Value
	$
Annual Benefits	
Land loss reduction	660
Structures Loss Reduction	200
Total Annual Benefit	860
Total Annual Cost	170,000
Net Annual Benefit	-169,140
Benefit/Cost Ratio	0.01

(3) Major Environmental Features/Preliminary Assessment of Alternative IIIA - Under Alternative IIIA, environmental benefits would result due to the mitigation of erosion caused by the Cleveland Harbor project. Temporary impacts to water and air quality would occur due to the placement of fill and the operation of heavy machinery during each annual beach nourishment operation. No significant impacts to sediment quality would be expected. The feeder beach fill operations would require the yearly commitment of sand and fuel required for sand placement. During sand placement operations along the Lake Erie shoreline, minor impacts may occur to benthic macroinvertebrates, plankton, and fishery resources at the work site. However, since the potential feeder beach site is a high energy environment which is constantly disturbed by wave action, no significant long-term impacts to benthos, plankton, or fish are expected to occur. Limited quantities of terrestrial vegetation may be destroyed and some minor displacement of small mammals and/or birds may occur during feeder beach fill operations.

Implementation of this plan would constitute a business activity which would provide some benefits to business, employment, and income tax revenues. Temporary impacts to noise, aesthetics, and possibly recreation may occur at the construction site. Although a number of residences in Bratenahl may be

eligible for listing in the National Register of Historic Places, no specific impacts to cultural resources have been identified. Further coordination regarding cultural resources will be required if this alternative is given further consideration.

e. Alternative IIIB - Feeder Beach - Reach 10, Perkins Beach.

(1) Plan Description - The Perkins Beach area has been denied 2,100 cubic yards of littoral material annually by the Federal dredging on the Cuyahoga River. Annual replacement of this amount plus 20 percent ± for offshore losses would mitigate all of the Federal responsibility. This alternative would then provide for placement of 2,500 cubic yards of sand as a feeder beach annually at the location shown on Figure 12. The material would be obtained commercially, trucked and spread at the site near the west end to take advantage of the predominant west to east wave direction. It would quickly be integrated into the alongshore littoral system by the natural wave climate.

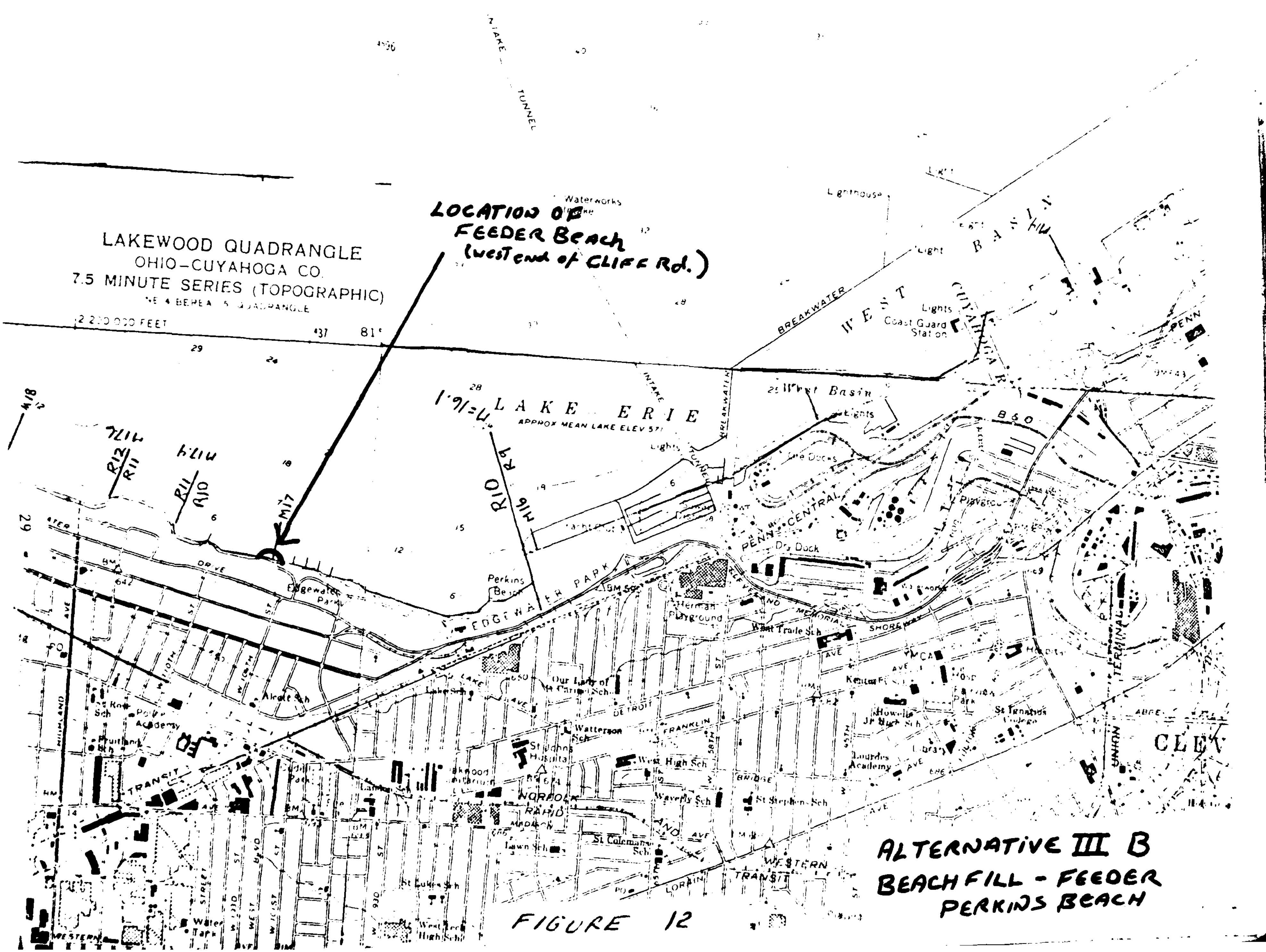
(2) Cost and Economic Efficiency of Alternative IIIB - The estimated first cost (and annual cost since this would be an annual operation) for the 2,500 cubic yards of sand placed on shore at the location shown in Figure 12 is $56,000. Federal participation in the cost of this alternative would be limited to $44,030, the average annual cost for Alternative IIB, the least costly plan to mitigate the Federal responsibility at this site. A local sponsor would be required to pay all costs in excess of this amount, or $11,970 on an annual basis.

The average annual benefit is derived from mitigation of 0.5 feet per year of shoreline erosion, all of which would be accomplished by this plan. There would be a reduction in land loss of $600 plus $1,340 for a similar reduction in structural damages, for a total annual benefit of $1,940.

With total annual costs of $56,000 and total annual benefits of $1,940, the net annual benefits are -$54,060 and the benefit-to-cost ratio is 0.04. Table 5 summaries this information.

Table 5 - Summary of Benefits and Costs for Alternative IIIB, July 1982 Price Levels

Item	Annual Value
	$
Annual Benefits	
Land Loss Reduction	600
Reduction in Structures Damages	1,340
Total Annual Benefit	1,940
Total Annual Charges	56,000
Net Annual Benefits	-54,060
Benefit/Cost Ratio	0.04


LAKEWOOD QUADRANGLE
OHIO-CUYAHOGA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
LOCATION OF FEEDER Beach
(west end of CLIFF Rd.)
LAKE ERIE
APPROX MEAN LAKE ELEV 571
BREAKWATER
WEST BASIN
CUYAHOGA R
Coast Guard Station
Lighthouse
Waterworks
INTAKE
TUNNEL
Perkins Beach
Edgewater Park
EDGEWATER PARK
PENN CENTRAL
Dry Dock
B&O
Herman Playground
West Trade Sch
West High Sch
Waverly Sch
St Stephens Sch
Lourdes Academy
St Ignatius College
CLEV
TERMINAL
UNION
DETROIT
FRANKLIN
BRIDGE
LORAIN
WESTERN TRANSIT
NORFOLK RAPID
R12
R11
R10
R9
M17
M16
1.91=H
ALTERNATIVE III B
BEACH FILL - FEEDER
PERKINS BEACH
FIGURE 12

(3) Major Environmental Features/Preliminary Assessment of Alternative IIIB - Alternative IIIB would produce the same general environmental impacts as discussed under Alternative IIIA above, although the impacts under Alternative IIIB would occur at Perkins Beach, rather than at Bratenahl. No significant cultural resources have been identified at Perkins Beach.

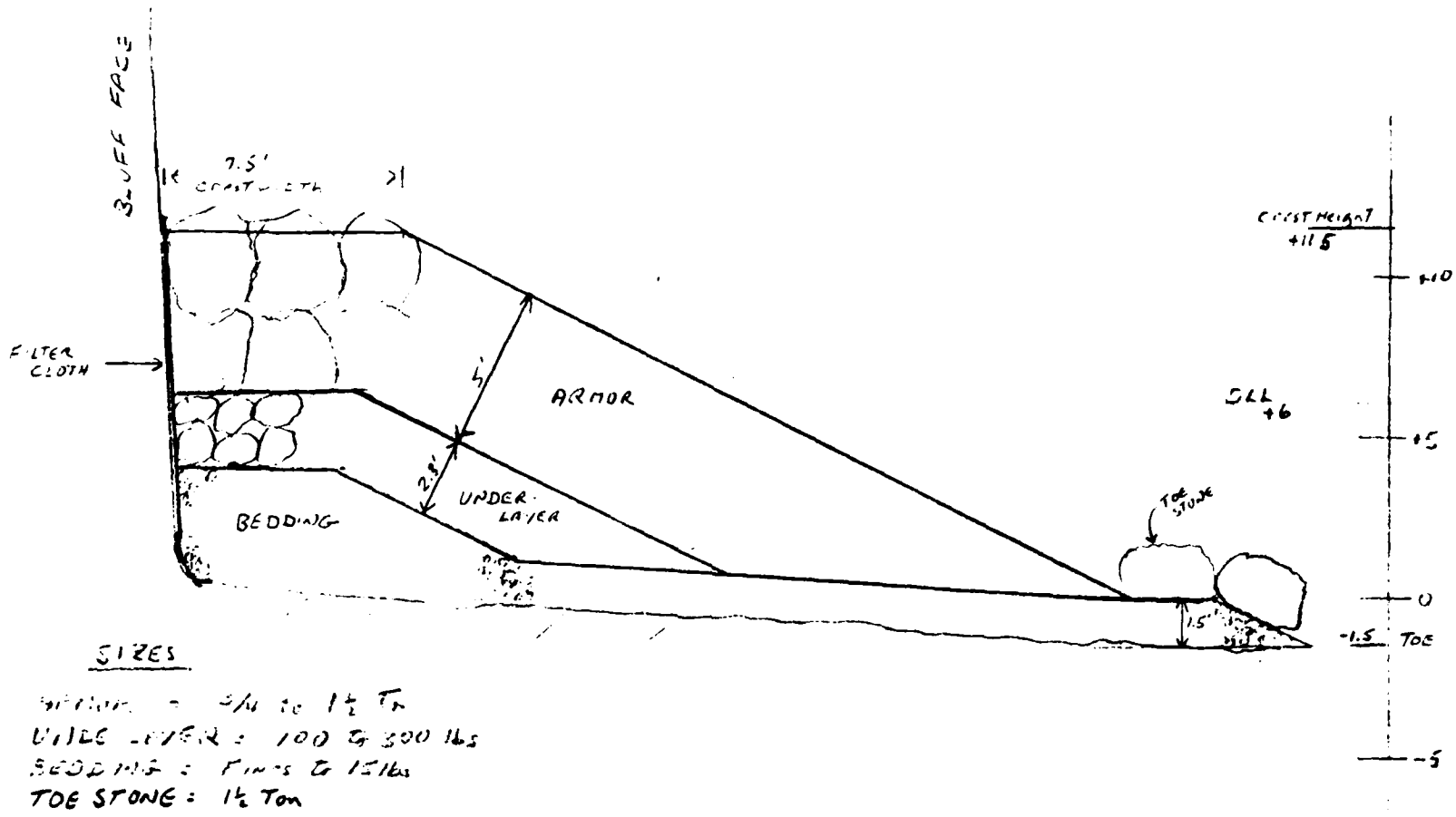
f. Alternative IVA - Revetment at Reach 8, Bratenahl.

(1) Plan Description - This alternative would provide a rubblemound revetment along the entire 2.4 miles of the Bratenahl shoreline. A generalized cross section has been developed for the total reach (13,000 feet) based upon limited, readily available data and is shown on Figure 13. No surveys have been performed but would be required if this alternative is given further consideration. Construction details have not been developed for this cursory evaluation but construction would have to be coordinated with the numerous, private protective structures currently in place.

(2) Cost and Economic Efficiency of Alternative IVA - The first cost of construction for this alternative is $9,080,000 at July 1982 price levels. Annual charges for the 50-year economic life at 7-5/8 percent interest are $710,330, exclusive of interest during construction and maintenance. Average annual benefits are $13,540 and were obtained based upon elimination of the entire 1.1 feet of erosion annually and the resultant land and structures loss prevented, since it is anticipated that this plan would stop all erosion. Net benefits are -$696,790 and the benefit-to-cost ratio is 0.02. Federal participation in the cost of this alternative would be limited to $160,200 on an annual basis, the annual cost of Alternative IIA which is the least costly alternative to mitigate the Federal responsibility at this site. A local sponsor would be required to pay all costs in excess of this amount, or $550,130 on an annual basis. Table 6 summarizes this information.

Table 6 - Summary of Benefits and Cost for Alternative IVA, July 1982 Price Levels

Item	Annual Value
	$
Annual Benefits	
Land loss reduction	10,540
Structures Loss Reduction	3,000
Total Annual Benefit	13,540
Total Annual Cost	710,330
Net Annual Benefit	-696,790
Benefit/Cost Ratio	0.02



SKETCH OF GENERALIZED REVETMENT
CROSS SECTION
(ALTERNATIVE IV A and B)

FIGURE 13

(3) Major Environmental Features/Preliminary Assessment of Alternative IVA - Alternative IVA would provide environmental benefits by mitigating Federally induced erosion and by halting all erosion for the life of the structure. Temporary impacts to water and air quality would occur due to the operation of heavy machinery during construction. No significant adverse impacts to sediment quality should occur. Construction of the revetment and periodic maintenance would require the commitment of structural stone and fuel required for machinery operation. Some temporary impacts to benthic macroinvertebrates, plankton, and fish may occur during construction. Positive long-term benefits to benthos and fish might be provided by the rubble revetment as discussed in Appendix D, depending on the design configuration of the structure and the amount of aquatic habitat modified. The destruction of some terrestrial vegetation and the displacement of some small mammals and/or birds may occur during construction.

Implementation of this plan would constitute a business activity which would provide short-term benefits to business, employment, and income tax revenues. Temporary impacts to noise, aesthetics, and possibly recreation may occur at the construction site. Man-made resources, primarily in the form of shore protection, would be modified under this plan. Although a number of residences in Bratenahl may be eligible for listing in the National Register of Historic Places, no specific impacts to cultural resources have been identified. Further coordination regarding cultural resources will be required if this alternative is given further consideration.

g. Alternative IVB - Revetment at Perkins Beach, Reach 10.

(1) Plan Description - This alternative plan would provide a rubblemound revetment over a portion of Reach 10 (Perkins Beach area) extending from the shale bluff near the west end, 1,400 feet east to the western end of the Edgewater Park revetment as previously shown on Figure 7. The typical revetment section previously presented for Alternative IVA is also the preliminary section for consideration under this alternative. Refinement would be required based on actual field surveys if the plan is given further consideration. This plan would eliminate erosion from all causes, with a local sponsor required to assume costs in excess of those which would mitigate the Federal responsibility.

(2) Cost and Economic Efficiency of Alternative IVB - The first cost of construction for this alternative is $1,150,000 on July 1982 price levels. Average annual charges for the 50-year economic life at 7-5/8 percent interest are $89,960, exclusive of maintenance and interest during construction. Average annual benefits are $2,900 which consist of $1,560 for reduction in land loss plus $1,340 for loss of road access to homes off Cliff Drive. Net benefits are -$87,060 and the benefit-to-cost ratio is 0.03. Although the revetment would completely halt erosion from all causes, Federal participation would be limited to $44,030 on an annual basis, the annual cost of Alternative IIB which is the least costly alternative to mitigate the Federal responsibility at this site. A local sponsor would be required to contribute costs above this amount. Table 7 summarizes this information.

Table 7 - Summary of Benefits and Cost for Alternative IVB, July 1982 Price Levels

Item	Annual Value
	$
Annual Benefits	
Land loss Reduction	1,560
Loss of Road Access	1,340
Total Annual Benefit	2,900
Total Annual Charges	89,960
Net Annual Benefit	-87,060
Benefit/Cost Ratio	0.03

(3) Major Environmental Features/Preliminary Assessment of Alternative IVB - Alternative IVB would produce the same general environmental impacts as discussed under Alternative IVA above, although the impacts under Alternative IVB would occur at Perkins Beach, rather than at Bratenahl. Under Alternative IVB, public access to the parkland at Perkins Beach may also be restricted during construction. Increased fishing opportunities at Perkins Beach could potentially occur if the Perkins Beach groins were connected to the revetment and modified for use as a shoreline fishing area. No significant cultural resources have been identified at Perkins Beach.

PLAN COMPARISON

Table 8 summarizes the economic data for each of the four plans considered for Reaches 8 and 10. It is readily apparent from this tabulation that only Alternatives IIA and IIB - Offshore Disposal of Dredged Material at Bratenahl and Perkins Beach have any economic viability. The main problem associated with these alternatives is the uncertainty that the plan objectives will be accomplished. Although the full benefit for elimination of all Federally induced erosion has been included in the economic evaluation, no assurances of the percentage of dredged material placed offshore in 15 to 18 feet of water which will reach the nearshore littoral system are available. If, as suggested, 20 percent of the material dumped offshore reaches the nearshore littoral system, the calculated Federal responsibility will be mitigated. The costs of Plans IIA and IIB are also the Federal limits of dollar participation for all other alternatives because these plans provide the least costly alternatives for mitigating all of the Federally induced erosion. However, natural erosion would continue unabated and there probably would be little noticeable reduction in the total recession rate.

Alternative Plans IIIA and IIIB, Feeder Beaches at Bratenahl and Perkins Beach, respectively, eliminate the uncertainties associated with Plans IIA and IIB; i.e., the material placed enters the nearshore littoral system.

However, costs are excessive when related to benefits achieved for eliminating Federally induced erosion.

Table 8 - Comparison of Benefits and Costs
July 1982 Price Levels

Alternative	Average Annual Benefits	Average Annual Costs	B/C Ratio	Net Benefit
	$	$		$
IA	-	-	-	-
IB	-	-	-	-
IIA	221,580	160,200	1.4	+61,380
IIB	75,720	44,030	1.7	+31,690
IIIA	860	170,000	0.01	-169,140
IIIB	1,940	56,000	0.04	-54,060
IVA	13,540	710,330	0.02	-696,790
IVB	2,900	89,960	0.03	-87,060

Alternatives Plans IVA and IVB, Revetments at Bratenahl and Perkins' Beach, respectively, have the highest average annual costs, and the greatest negative net benefits. The revetments would provide reasonable stability to the shorelines mitigating Federally induced and most natural recession.

A summary matrix comparing the potential impacts associated with all of the proposed plans is presented in Table 9. The matrix is an indication of the general magnitude of potential beneficial and adverse impacts associated with the environmental parameters listed.

PLAN SELECTION

Based on the plan comparison, it is apparent that only Alternative Plans IIA and IIB have economic feasibility and possibility of implementation. These two plans, which provide for replacement of material lost to the littoral system due to the annual dredging of the Cuyahoga, would mitigate the entire estimated Federal responsibility at no additional cost, and satisfy the Section 111 requirements. Further study of these two plans under the Section 111 Authority is unnecessary and would involve unwarranted, additional expenditures and delays. Therefore, with the selection of these two plans, it is concluded that the Section 111 study should be terminated with implementation of the two plans under the regular, authorized Cleveland Harbor Operation and Maintenance Program.

Table 9 - Summary Matrix for Cleveland Section 111 Study Alternatives

Evaluation Criteria	Alternative IA: No Action Bratenahl Term: Short	Alternative IA: No Action Bratenahl Term: Long	Alternative IB: No Action Perkins Beach Term: Short	Alternative IB: No Action Perkins Beach Term: Long	Alternative IIA: Offshore Disposal Bratenahl Term: Short	Alternative IIA: Offshore Disposal Bratenahl Term: Long	Alternative IIB: Offshore Disposal Perkins Beach Term: Short	Alternative IIB: Offshore Disposal Perkins Beach Term: Long	Alternative IIIA: Beachfill Bratenahl Term: Short	Alternative IIIA: Beachfill Bratenahl Term: Long	Alternative IIIB: Beachfill Perkins Beach Term: Short	Alternative IIIB: Beachfill Perkins Beach Term: Long	Alternative IVA: Revetment Bratenahl Term: Short	Alternative IVA: Revetment Bratenahl Term: Long	Alternative IVB: Revetment Perkins Beach Term: Short	Alternative IVB: Revetment Perkins Beach Term: Long
Natural Environment																
Water Quality	0	0	0	0	-	0	-	0	-	0	-	0	-	0	-	0
Air Quality	0	0	0	0	0/-	0	0/-	0	-	0	-	0	-	0	-	0
Sediment Quality	0	0	0	0	*	*	*	*	0	0	0	0	0	0	0	0
Natural Resources	0	0	0	0	+	+	+	+	-	-	-	-	-	0/-	-	0/-
Endangered Species	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benthic Macroinvertebrates	0	0	0	0	-	*	-	*	0/-	0	0/-	0	0/-	+	0/-	+
Plankton	0	0	0	0	-	0	-	0	0/-	0	0/-	0	0/-	0	0/-	0
Fishery	0	0	0	0	-	*	-	*	0/-	0	0/-	0	0/-	+	0/-	+
Vegetation	0	0/-	0	0/-	0	0	0	0	0/-	0/-	0/-	0/-	0/-	0/-	0/-	0/-
Wildlife	0	0	0	0	0	0	0	0	0/-	0/-	0/-	0/-	0/-	0/-	0/-	0/-
Shore Erosion	0/-	-	0/-	-	+	+	+	+	+	+	+	+	+	+	+	+
Human Environment																
Noise	0	0	0	0	0	0	0	0	-	0	-	0	-	0	-	0
Aesthetics	0	-	0	-	0	+	0	+	-	+	-	+	-	+	-	+
Displacement of People	0	-	0	-	0	+	0	+	0	+	0	+	0	+	0	+
Displacement of Businesses	0	-	0	0	0	+	0	0	0	+	0	0	0	+	0	0
Displacement of Farms	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Community Cohesion	0	0/-	0	0/-	0	0/+	0	0/+	0	0/+	0	0/+	0	0/+	0	0/+
Community Growth	0	0/-	0	0/-	0	0/+	0	0/+	0	0/+	0	0/+	0	0/+	0	0/+
Business and Industrial Activity	0	-	0	0	-	0	-	0	+	0	+	0	+	0	+	0
Tax Revenues	0	0/-	0	0/-	0	0	0	0	+	0/+	+	0/+	+	0/+	+	0/+
Property Values	0	-	0	-	0	+	0	+	0	+	0	+	0	+	0	+
Public Facilities	0	0/-	0	-	0	0/+	0	+	0	0/+	0	+	0	0/+	-	+
Public Services	0	0/-	0	-	0	0	0	+	0	0	0	+	0	0	-	+
Employment/Labor Force	0	0	0	0	+	0	+	0	+	0	+	0	+	0	+	0
Man-Made Resources	0	-	0	-	0	+	0	+	0	+	0	+	0/-	+	0/-	+
Recreation	0	-	0	-	0/-	+	0/-	+	0/-	+	0/-	+	0/-	+	0/-	+
Cultural Resources	0	*	0	*	0	0	0	0	*	*	*	*	*	*	*	*

Potential Beneficial Impacts

\+ moderate significance
++ major significance

0 no impact, or insignificant impact
* not known at this time

Potential Adverse Impacts

\- moderate significance
-- major significance

SUMMARY OF ENVIRONMENTAL COORDINATION FOR ALL PLANS

Letters of coordination were sent to the U.S. Fish and Wildlife Service (USF&WS), the Ohio Department of Natural Resources (ODNR), the U.S. Environmental Protection Agency (USEPA), the State Historic Preservation Officer (SHPO), the National Park Service (NPS), the Cleveland City Planning Commission, the City of Cleveland's Director of Community Development, the President of the Cuyahoga County Commissioners, the Executive Director of the Cleveland-Cuyahoga County Port Authority, and the Cleveland Metroparks System.

Relevant information for Reaches 8 and 10 was provided by the Cleveland City Planning Commission and the Cuyahoga County Regional Planning Commission. The Cleveland Metroparks System declined to provide any information as the Metroparks had no controlling interest in Reaches 8 and 10. No response was received from the Director of Community Development, the President of the Cuyahoga County Commissioners, or the Cleveland-Cuyahoga County Port Authority.

The SHPO commented that a number of residences in Bratenahl appear to be eligible for listing in the National Register of Historic Places and that there do not appear to be any recorded cultural resources in the Reach 10 area. The NPS was not aware of any significant cultural resources which would be affected by any of the proposed project alternatives.

The Planning Aid Letter provided by the USF&WS contained a general discussion of fish and wildlife resources in the study area and included a discussion of environmental impacts associated with the project alternatives. The USF&WS stated that all construction alternatives proposed for Bratenahl and Perkins Beach probably would not cause significant adverse impacts on the aquatic resources of the area. They felt that Alternatives IVA and IVB may provide a net benefit for the aquatic resources of the Cleveland area. If Alternatives IVA and/or IVB are to be selected, the USF&WS recommended that modifying the revetments for use as shoreline fishing areas be investigated.

The USF&WS stated that if Alternatives IIA and IIB are selected as the preferred alternatives, future planning should define the disposal area and the site specific habitat of that area. With the selection of a preferred disposal site, they recommended that aquatic surveys be conducted to identify any site specific spawning, nursery, or feeding areas that may be impacted by placement of fill material. The USF&WS recommended that since the upper Cuyahoga River sediment testing was a "one shot" analysis, additional tests should be conducted on the material in the spring of 1983 or before the material is dredged and placed in the littoral system.

The USEPA stated that based on physical and chemical analyses, the sediments from the three upper Cuyahoga River sample sites (Stations 819, 815, and 812) appeared to be predominantly clean, fine-grained sands. They recommended further consideration of Alternatives IIA and IIB. The USEPA had no specific comments on the other proposed alternatives and did not anticipate that they would result in significant, adverse environmental impacts. They felt that the Buffalo District should investigate the use of sediments from the upper

Cuyahoga River channel in the construction of a feeder beach fill (pumping the clean sand from the dredge site or a hopper dredge onto the shoreline).

The ODNR had no specific objection to any of the proposed alternatives and did not expect that any of the alternatives provided would result in significant environmental impacts. Specific comments regarding several of the project alternatives were provided.

CONSIDERED FUTURE ENVIRONMENTAL ACTIONS UNDER CLEVELAND HARBOR OPERATION AND MAINTENANCE PROGRAM

Based on the comments received as a result of interagency coordination, future environmental actions are as follows. Sediment tests and fishery/benthic surveys will be performed for the Alternative IIA and IIB disposal sites. Additional testing of the Cuyahoga River sediments will also be performed. Agency and public coordination will be conducted, as appropriate, during future project planning to fulfill the requirements of the National Environmental Policy Act (NEPA), Section 404 of the Clean Water Act, and other applicable environmental statutes.

Since the Cleveland Harbor Section 111 Study is to be terminated, the references in Appendix D (and all other appendices) to Stage 3 planning efforts are no longer appropriate. Compliance with environmental protection statutes will be met during O&M planning prior to implementation of the chosen alternatives. In order to insure compliance with NEPA, the Buffalo District proposes to prepare an Environmental Assessment (EA) and Finding of No Significant Impact (FONSI).

CONCLUSIONS

The study to date has determined that only two areas have been significantly affected by the Cleveland Harbor Navigation Project. These areas are adjacent to the harbor and have been identified as Reach 8, Bratenahl, and a portion of Reach 10, termed Perkins Beach. The determined impact to these areas is one of denial of beach building material to the littoral system due to the annual dredging of the Cuyahoga River. The Section 111 Authority provides for mitigation of these damages with the entire cost thereof borne by the United States, up to a limit of $1 million per project, without specific Congressional authorization.

It has also been determined that Alternative Plans IIA and IIB are economically feasible and would mitigate the entire Federal responsibility. They would provide for disposal of suitable, sand-sized material dredged from the Cuyahoga River at Bratenahl and Perkins Beach, respectively. Disposal would be offshore in 15 to 18 feet of water. The calculated quantities required to mitigate Federal responsibility are 35,600 cubic yards of sand-sized material at Bratenahl and 11,900 cubic yards of sand-sized material at Perkins Beach assuming a 20 percent effectiveness of material placed offshore entering the alongshore littoral system with 84 percent of the total material placed classified as sand.

It has also been determined that disposal of material offshore at the two locations is less costly than disposal of the same quantity of material in Dike 14, as is the current practice. This determination was based on the best current available information regarding offshore disposal costs and actual bid prices for disposal in Dike 14. However, there is a slight possibility that some time in the future, actual bid prices for the proposed work could be more costly than similar dredging and disposal in Dike 14. Even if this were to occur, the suggested program should still be continued as it conserves a valuable natural resource by returning sand to the littoral system, rather than removing it from the system forever, as well as mitigating the determined, Federal project induced damages.

With the extent of Federally induced damages to the shoreline adjacent to Cleveland Harbor established and the proposed method of mitigating these damages determined, it is obvious that further study under Section 111 is unwarranted and the study should be terminated. The recommended plan of mitigation would be implemented by the Buffalo District under its ongoing Cleveland Harbor maintenance program. The District would also conduct the required sediment sampling and testing program, prior to and after the nourishment program begins under the O&M program. This Termination Report will provide the basis and authorization for the District to take over and carry out the nourishment program, as well as to terminate the Section 111 Study at Cleveland Harbor, OH.

PLAN IMPLEMENTATION - OPERATIONS AND MAINTENANCE PROGRAM

During the course of this study, coordination was initiated with a number of agencies as evidenced by correspondence in Appendix D. The USF&WL Service suggested that if Alternatives IIA and IIB were selected as the preferred alternatives, the disposal areas should be tested to provide specific information on the aquatic habitat of the area. The United States Environmental Protection Agency also recommended further consideration of the selected alternatives. In view of these comments and others received, the following will be undertaken by the Buffalo District under the Cleveland Harbor Operations and Maintenance Program.

a. Actions to be Taken Prior to Initiation of the Beach Nourishment Program.

(1) Obtain sediment grab samples from the upper Cuyahoga River prior to initiation of the beach nourishment program.

(2) Perform Bulk Chemical Analysis and Gradations on the sediment samples taken from the Cuyahoga River and use this information to confirm the continued suitability of this material for open-lake disposal.

(3) Perform Benthic/Fisheries Studies at the two disposal sites.

(4) Prepare and coordinate with all concerned agencies a Public Notice, a 404 Evaluation, an Environmental Assessment, and a Finding of No Significant Impact (FONSI) for the disposal sites.

(5) Implement plans IIA and IIB which consists of placing suitable dredged material from the upper Cuyahoga River in the offshore area as close as possible to Bratenahl and Perkins Beach. Quantities placed will be contingent on total quantities of suitable material available, and will approximate a 3 to 1 ratio, Bratenahl to Perkins Beach.

b. Action to be Taken Subsequent to Initiation of the Beach Nourishment Program.

(1) Conduct future sampling/testing programs to monitor the continued suitability of the dredged material for open-lake disposal in conjunction with the current sediment testing schedule for dredged material at Cleveland Harbor (i.e., once every 5 years).

TIMETABLE FOR IMPLEMENTATION

The District will conduct the required sampling and testing program of the source and disposal sites in 1983. If the results are favorable, as expected, the recommended program could begin in 1984.

RECOMMENDATIONS

I recommend that this Section 111 Study be terminated. I further recommend that Alternatives IIA and IIB be implemented by the Buffalo District under the Operation and Maintenance Program for Cleveland Harbor to mitigate the shoreline damages attributable to the Federal Harbor Project, totally at Federal expense. These alternatives will provide for disposal of suitable dredged material from the Cuyahoga River in the offshore areas as close as possible to Bratenahl and Perkins Beach as shown on Figures 8 and 10, respectively. Quantities of material to be placed will be dependent on the amount of suitable material available from the dredging operation and should approximate about 47,500 cubic yards of sand-sized material annually (35,600 cubic yards to be placed at Bratenahl and 11,900 cubic yards at Perkins Beach, or a ratio of about 3 to 1). Continued placement of any material in the offshore areas is contingent upon the continued suitability of the dredged material for open-lake disposal.

The Buffalo District, prior to placement of any materials in the offshore, will perform the tasks noted in the previous section. The total program will be accomplished at the expense of the United States Government, without cost or obligation to local interests. The program will be reviewed periodically to determine if:

a. the mitigative measures are accomplishing the desired objectives;

b. if the program continues to be cost effective; and

c. if the nourishment is beneficial to the environment.

If the program meets these criteria, disposal of acceptable dredged material from the Cuyahoga River offshore of Bratenahl and Perkins Beach areas will be continued indefinitely. Otherwise, the program will be reevaluated and subsequently terminated, if appropriate.

ROBERT R. HARDIMAN
Colonel, Corps of Engineers
District Engineer

CLEVELAND HARBOR, OH
SECTION III

APPENDIX A
COASTAL EVALUATION

April 1983

CLEVELAND HARBOR
CLEVELAND, OHIO
SECTION 111

APPENDIX A

EVALUATION OF SHORELINE EROSION AND FEDERAL IMPACTS

A1. REGIONAL SHORELINE REPORT

A preliminary evaluation of the shoreline both east and west of Cleveland Harbor was conducted with the primary purpose being to identify portions of shore most potentially susceptible to impacts under the Section III criteria.

The regional shoreline evaluations include the Cuyahoga County shoreline from Rocky River east through Cleveland to the Cuyahoga-Lake County line and includes the communities of Lakewood, Cleveland, Bratenahl, East Cleveland, and Euclid. This includes over 21 miles of shore, of which almost 7 miles are within the Cleveland Harbor and Edgewater park area and thus are protected by the harbor structures from aggrevated shore erosion. Of the regional shore study, 9 miles are east of the harbor and 5 miles are west of the harbor. The study shore is generally characterized by bluffs of various composition (i.e., bedrock shale, lacustrine silts and clays, glacial till, and artificial fill) and various levels of shore protection, both of which greatly influence the local erosion rates.

The shoreline was subdivided into 14 study reaches for ease of discussion. Each reach is a socioeconomic unit which can be identified by a recognizable geographic boundary. Within each reach there is a general uniformity of recession, geology, and level of shore protection. Each reach is listed and identified in Table A1.

The documentation for each reach was developed based on quadrangle sheets, 1978 videotapes, various series of aerial photography ranging from 1938 to 1980, ODNR recession rate maps, site visits, and general literature.

A2. GENERAL GEOLOGY

The Cuyahoga County shoreline is dominated by shale bluffs to the west of Cleveland Harbor and glacial till/post-glacial lacustrine bluffs to the east. The bedrock of this shore area is Devonian shale of the Chagrin or Ohio (Cleveland Shale) Formations and is generally described as thinly bedded, jointed, blue-gray shale which occasionally contains pyrite or calcareous concretions and silt or sandstone lens. The bedrock is generally flat-lying with a very gentle dip to the south.

The bedrock surface has been disected by the historic and modern drainage patterns of the Cuyahoga and Rocky Rivers. The pre-glacial drainage system involved streams which connected to a trunk stream whose valley was cut to a level far below the bed of the present Lake Erie. Borings along the lower Cuyahoga Valley have shown the presence of a remarkably deep channel with the top of bedrock near sea level. The preglacial Cuyahoga River valley diverts

from the present valley near the Willow Freeway crossing (6.8 miles inland) where it assumes a course farther east than the present Cuyahoga. The deepest part of the preglacial valley runs nearly north from Willow along or near East 55th Street to the shore of Lake Erie approximately 1/2 mile west of Gordon Park. The valley of the preglacial Rocky River makes a gap approximately one mile wide through the shale bluff a short distance west of the present Rocky River mouth.

A3. SHORE RECESSION RATES

The history of Cleveland Harbor is too long and the Cuyahoga County shore too complex to allow development of a recession rate data base sufficient to isolate the impact of the Federal Harbor on adjacent shores. Cleveland Harbor was started in the 1820's and no shoreline maps existed prior to 1876. The earliest aerial photography is from 1938 and yet the present Cleveland Harbor configuration was in place by the turn of the century. It is impossible to develop a before and after Cleveland Harbor construction data base. In addition, after reviewing the aerial photography, site inspections, ODNR reports, and House Document No. 502, 81st Congress (13 March 1950) it becomes obvious that the many non-Federal shore structures and private shore protection work prohibit isolation of a natural recession rate from the Federal impacts. In some areas excessive filling operations have actually caused an apparent bluff line accretion. Therefore, recession rates were developed to cover long periods of time in an attempt to average out temporal effects. The basic purpose of the recession rate data is to identify portions of the regional shore which has experienced abnormally high recession rates which may require specific explanation (i.e., the Federal Harbor).

Ohio Department of Natural Resources (Guy, 1975) has compiled open file maps showing shore recession lines for Cuyahoga County from 1876, 1938, and 1973. For the purpose of this study, shoreline points were selected at 1,000-foot intervals and recession rates determined (Table A-2). The average recession rates for the total period (1876-1973) are graphed in Figure A-1, illustrating the average rate throughout the 14 reach study area. A breakdown of recession rates for the shorter time periods of 1876 to 1938 compared to 1938 and 1973 are graphed in Figure A-2.

Figures A-1 and A-2 illustrate the significant effect of local geology and shore structures on recession rates. Reaches 3, 12, and 14 are bedrock (shale) bluff areas which, consequently erode at a slow rate of less than 1 ft/yr. Reaches 5, 7, and 9 are totally protected by major breakwater structures and show no recession. Reaches 7, 9, 11, and 13 actually exhibit shoreline growth due to landfill operations. Reaches 3, 6, and part of 4 are heavily protected to the point where shore recession has been practically halted, particularly since 1938. The only significant recession rates (i.e., recession more than 1 ft/yr) are for: the east end of Reach 1 near the Lake-Cuyahoga County line; immediately east (downdrift) of Wildwood Park during the 1938-1973 period of time; the Bratenahl shoreline (Reach 8) during the 1876 to 1938 period; the Perkins Beach area in the center of Reach 10; and finally, immediately east (downdrift) of Lakewood Park in Reach 12, particularly during the 1876-1938 period. The aforementioned high recession rates east of Wildwood Park and east of Lakewood Park were probably caused

Table A1 - Cleveland Harbor Section 111 - Study Reaches

Reach	Location	Shore Miles	Length (Miles)	Quadrange	Geography	Shore Description	Recession Rates
1	Cuyahoga Lake County Line to 250th Street	0.0-1.3	1.3	East Lake and East Cleveland, Ohio	Euclid: Residential, Apartment complexes near center of reach - bluff edge, near unprotected eroding bluffs. Some protection being put in 1981-1982.	30-foot high or lower till bluffs, generally unprotected. Narrow sandy beach fronts bluff throughout reach. Bluff face is unstable where former protection has recently failed. Fill operations. Higher eroding bluffs toward the east end of the reach. Till is Ashtabula till, which is 23 percent sand.	1876-1937 = 0.98 ft/yr 1937-1973 = 0.47 ft/yr 1876-1973 = 0.80 ft/yr Highest recession near center of reach during 1876-1937 at 1.1 to 1.9 ft/yr and also at eastern end of reach during 1937-1973 at 2.8 ft/yr.
2	250th Street to Moss Point Jetties	1.3-2.4	1.1	East Cleveland, Ohio	Euclid: Residential shore, high rise apartment complexes at east end of reach. Low level of protection for apartment complexes.	Till bluffs 30-foot high. Soft shale outcrops near base of cliff. Not a heavily protected shore. Some areas of a raw eroding shore with landfill operations replacing lost bluff face. Beaches are gray-shale fragment covered. Unprotected areas are unstable. Till is Hiram Till which is 12 percent sand.	1876-1937 = 0.66 ft/yr 1938-1973 = 0.10 ft/yr 1876-1973 = 0.41 ft/yr Highest recession of this reach was at a point 2,000 feet west of the east end of the reach during 1876-1937 at 1.23 ft/yr. Generally recession was much higher prior to 1937.
3	Moss Point Jetties to 185th Street	2.4-3.9	1.5	East Cleveland, Ohio	Euclid: Heavy concentration of residential structures. Euclid-Glenville Hospital at west end and Euclid Park at east end. Heavy shore protection in front of homes on Edgecliff Drive. Hospital protected only by a low sheetpile wall.	Narrow sandy deposits at base of bluff everywhere except in front of the hospital. Low concrete walls at the base of the bluffs stabilize the bluff face. (Bluffs are 20-25 feet high.) Costly level of shore protection - substantial concrete seawalls, graded and terraced lawns where protected. Some unprotected eroding bluffs toward east end of reach. Sandy toward center of reach. Shale at water's edge near east end.	1876-1938 = 0.23 ft/yr 1938-1973 = 0.0 1876-1973 = 0.15 ft/yr Very slow recession. No recession between 1938 and 1973. Highest rate at east end and at west end of reach of approximately 1/2 ft/yr during 1876-1938.
4	185th Street to Wildwood Park (East Side).	3.9-4.9	1.0	East Cleveland, Ohio	Euclid: Residential area heavily developed. Includes Beachwood Park (public access and St. Joseph's High School. Concrete seawall protection in front of high school.	Low (25 feet) till bluff with shale outcropping near base. No sandy beaches. Generally an unprotected shore backed by actively eroding bluffs and fill areas. Protection is heavy toe works on dumped rubble.	1876-1938 = 0.27 ft/yr 1938-1973 = 0.69 ft/yr 1876-1973 = 0.42 ft/yr Generally a slowly receeding shore, particularly in the eastern half. However, high erosion rates from 1938-1973 for the extreme west end of reach which is immediately downdrift of the Wildwood Park Marina. Highest rate in this area is 2.3 ft/yr, or averaged over the 650 feet east of Wildwood it is 1.6 ft/yr.
5	Wildwood Park	4.9-5.0	0.1	East Cleveland, Ohio	Euclid-Wildwood Park Marina: Laved-up stone breakwaters enclose a marina. Marina is a headland which projects approximately 600 feet offshore. Major water	Small marina and public access point projecting from former Euclid Creek flood plain. Small pocket beach on east side and creek mouth spit on west side.	Prior to 1949 construction of the Wildwood Park Marina this was the Euclid Creek flood plain with no apparent long-term recession. Since 1949 this area has been protected and the
6	West Breakwater of Wildwood Park to East Breakwater of White City Park.	5.0-6.3	1.3	East Cleveland, Ohio	East Cleveland, Residential for western half of reach. Eastern half includes the abandoned Euclid Beach Park (amusement park) and some new high rise apartment buildings. Generally more rural to east.	Sand beach fillet at west end trapped by White City and sand at east end trapped by remaining groins of Euclid Beach Park and flood plain/bar of the Euclid Creek mouth. However, majority of shore is a heavily protected unstable bluff (25 feet high). Lots of landfill attempts and generations of heavy rubble, stone block, and timber crib toe protection. Access road for approximately 10 homes is being lost. Unprotected areas very unstable.	1876-1938 = 0.23 ft/yr 1938-1973 = 0.0 1876-1973 = 0.15 ft/yr Very slow erosion rate.
7	White City Park Sewage Treatment Plant.	6.3-6.8	0.5	East Cleveland, Ohio	White City Park Sewage Treatment Plant: No longer is there public access to the beach and park. A small-boat marina on east side. Filling operation in center segment.	Shore completely protected by Sewage Treatment Plant and Park. Beach at west end is trapped by breakwater structures and has built up to the degree of extending its tail westward beyond the protected area. Probably responsible for trapping large quantities of material from the Bratenahl shore. Also have a fillet trapped on east side of the White City headland.	White City Park Sewage Treatment Plant built in 1933. Shoreline is heavily protected and modified. No Apparent recession.
8	Cleveland-Bratenahl East Boundary to the West Boundary	6.8-9.2	2.4	East Cleveland, OH/Cleveland, North, OH	Bratenahl. Upperclass residential shore. Federal Dredge Disposal Site No. 14 at west side. Long-term sequence of shore protection efforts and failures. Buried Cuyahoga River channel acts as an aquifer for ground water causing high rates of bluff face seepage.	Glacial till filling the preglacial Cuyahoga River valley forms a 25-foot high bluff. Shoreline almost totally modified by artifical fill, seawalls, offshore breakwaters, revetments, etc. Historically, low offshore stone block breakwaters were built. These were overtopped and unconsolidated bluff lost during high water of 1970's. Beach developed at east end of reach due to trapping effect of White City Park.	1876-1938 = 1.61 ft/yr 1938-1973 = 0.23 ft/yr 1876-1973 - 1.13 ft/yr Highest recession rate recorded in this study is for the 3,000 feet immediately west of White City during the period 1876-1938 of approximately 2.8 ft/yr. Recession rate for rest of reach is also high for the preshore protection period (1876-1938).

Table A1 - Cleveland Harbor Section III - Study Reaches (Cont'd)

Reach	Location	Shore Miles	Length (Miles)	Quadrange	Geography	Shore Description	Recession Rates
9	Bratenahl-Cleveland West Boundary to West side of Edgewater Park Fill Area.	9.2-16.1	6.9	Cleveland North/Cleveland South, Ohio	Cleveland Harbor Shore including Gordon Park, Diked Disposition Areas, Burke Airport and Edgewater Park Marina: Federal Harbor-navigation channels below mean lake level found only 500 feet offshore.	Original shore was further landward than at present and consisted of an easily eroded glacial deposit which filled the preglacial Cuyahoga River Valley. Present shore is very irregular because of numerous slips and piers. Seawalls front 92 percent of the shore and the only unprotected areas are just west of the Cuyahoga River. Shore is totally protected and heavily modified.	Shore consists of fill material placed lakeward of the 1876 shoreline during the past 100 years. Shore modified and protected. Development has been accompained by a steady decline in the number and size of beaches. In 1876 beaches fronted 36 percent of the shore in three separate segements totalling 2.4 miles of beach. By 1938 only 4 percent of shore was beach. No beaches at present.
10	West Side of Edgewater Park Fill Area to East Side Bramley Estate	16.1-17.4	1.3	Cleveland South, OH/Lakewood, Ohio	Cleveland: Includes public park/beaches at Perkins Beach and Edgewater Park. Residential development only at west end of reach and behind Perkins Beach.	Soft Chagrin Shale and fill at west end of reach. Lacustrine, silty bluffs from Perkins Beach east through Edgewater Major landfill operations in a number of areas throughout this reach. Series of groins built at Edgewater between 1913 and 1922 and five semi-permeable groins built in 1944 at Perkins Beach Edgewater Beach is the widest and longest beach west of Cleveland Harbor. Some pocket beaches at west end of reach.	1876-1938 = 1.01 ft/yr 1938-1973 = 0.79 ft/yr 1876-1973 = 0.90 ft/yr Highest recession in reach is the area of Perkins Beach (2,000 feet east of Bramley estate) at 1.9 ft/yr from 1876-1973, averaging 1.3 ft/yr over the 2,000 feet of shore fronting Perkins Beach.
11	Bramley Estate	17.4-17.6	0.2	Lakewood, OH	Cleveland: Seawall and fill containment area built 1926. Residential protected by rubblemound and concrete seawall. A small-boat harbor at east end is partly filled with sand.	Artificial headland created by rubble-mound and concrete seawall and appreciable filling. Headland sticks out 300 feet from normal trend of the shore. West end has concrete, east end blocks of stone.	1876-1938 = 0.52 ft/yr 1938-1973 = 0.36 ft/yr 1876-1973 = 0.46 ft/yr Eastern half of Bramley Estate has eroded through time, whereas the western half has been stabilized by the shore protection works. Most of the east end erosion occurred prior to 1938.
12	West Side of Bramely Estatee East Side of Lakewood Park	17.6-19.2	1.6	Lakewood, OH	Lakewood: Western extent of reach is residential, eastern half contains numerous apartment buildings and condominums. Large multiple dewellings clinging to the top of a 68-foot high bluff. Shore protection in this area. "Gold Coast" contains at least 13 high rise buildings.	Chagrin Shale bluff 60 feet high is undercut by wave action at the base. The western extent of the reach is very irregular as the shale has unevenly eroded resulting in a series of headlands and pockets. Gravel pocket beaches common in shale identation and at east end where a broad beach has built updrift of Bramley Beach.	1876-1938 = 0.90 ft/yr 1938-1973 = 0.48 ft/yr 1876-1973 = 0.75 ft/yr Highest erosion is in the western half prior to 1938 over the 4,000 feet to the east (downdrift) of the Lakewood Park Fill area. Recession rate prior to 1938 is 1.1 ft/yr, prior to 1973, it is 1.0 ft/yr.
13	Lakewood Park	19.2-19.5	0.3	Lakewood, OH	Lakewood Park is a public recreational park which includes playing fields, swimming pools tennis courts, and support buildings built on top of a 60-foot high landfill which is only marginally protected by a low stone block revetment.	Modified and protected shore. Landfill behind large stone and concrete block revetment. Quantities of landfill are eroded from the bluff face above the shore protection adding littoral material to the system.	1876-1938 = 0.61 ft/yr. Seawall and groin with some fill originally constructed in 1928 and was rebuilt as a substantial head land in 1938. Since 1938, large quantities of fill have been added beyond the historically documented shore.
14	West Side of Lakewood Park to Rocky River	19.5-21.2	1.7	Lakewood, OH	Residential shore a-top a 60-foot high shale bluff. Shore access only marginally protected by a low stone block revetment.	Chagrin Shale bluff. Bluff material is a soft, fissile shale which in undercut by wave action at the waterline. Some evidence of mass failure as blocks of the shale collapsed along joint lines. Only very minor sand deposits on small isolated pocket beaches within shore inundations. No private shore protection although low offshore breakwater structures currently being built, no beaches.	1876-1938 = 0.40 ft/yr 1938-1973 = 0.17 ft/yr 1876-1973 = 0.30 ft/yr Generally, a very slowly receeding shore. Highest rate of approximately 0.6 to 0.7 ft/yr is at the eastern end of the reach (Summit Avenue east to Lakewood Park). Rest of reach has experienced negligible recession.

BY Pope DATE Feb 82 SUBJECT Cleveland Hill Recession Rates SHEET NO. 1 OF 3

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Based on ODNR Open File Map No. 95

TABLE A-2

Reach	Length	PROFILE	1876-1937 (61 yr) recession	1876-1937 (61 yr) rate	1937-1973 (36 yr) recession	1937-1973 (36 yr) rate	1876-1973 (97 yr) recession	1876-1973 (97 yr) rate	
1	7000	0	40'	.66	100'	2.78	140'	1.44 ft/yr	
		1000'	115'	1.89	-	-	115'	1.19	
		2000'	65'	1.07	-	-	65'	.67	
		3000'	70'	1.15	15'	.42	95	.98	
		4000'	80'	1.31	-	-	80'	.82	
		5000'	30'	.49	20	.56	50	.52	
		6000'	25'	.41	-	-	25'	.26	
		7000'	50'	.82	-	-	50'	.52	
			AVG =	.98		.47		.80	
2	6000'	0	50'	.82	-	-	50	.52	
		1000	-	-	-	-	-	-	
		2000	90'	1.23	40' Fill	-	45' Fill	.46	
		3000	25'	.41	-	-	25'	.26	
		4000	45	.74	20	.56	65'	.67	
		5000	55	.90	-	-	55'	.57	
		6000	30'	.49	5'	.14	35	.36	
			AVG =	.66		.10		= .41	
			1876-1938 (62 yr)		1938-1973 (35 yr)				
3	7000'	0	40	.65	-	-	40'	.41	
		1000	30	.48	-	-	30'	.31	
		2000	-	-	-	-	-	-	
		3000	5'	.08	-	-	6	.05	
		4000		-	-	-	-	-	
		5000		-	-	-	-	-	
		6000	10	.16	-	-	10	.10	
		7000	30	.48	-	-	30	.31	
			AVG =	.23		0		= 0.15	
4	5000	0	-	-	-	-	-	-	
		1000	-	-	20	.57	20	.21	
		2000	-	-	-	-	-	-	
		3000	45	.73	-	-	45	.46	
		4000	45	.73	45	1.29	90	.93	
		5000	10	.16	80	2.29	90	.93	
			AVG =	.27		= .69		= .42	
5	1100	PROTECTED SECTION FLOODPLAIN							WILDWOOD

TABLE A-2 (CONTINUED)

REACH	LENGTH	PROFILE	1876-1938 (62yr) recession	1876-1938 (62yr) rate	1938-1973 (35yr) recession	1938-1973 (35yr) rate	1876-1973 (97yr) recession	1876-1973 (97yr) rate	
6	6500	0	5	.08	-	-	5	.05	
		1000	15	.24	-	-	15	.15	
		2000	35	.56	-	-	35	.36	
		3000	-	-	-	-	-	-	
		4000	30	.48	-	-	30	.31	
		5000	15	.24	-	-	15	.16	
		6000	-	-	-	-	-	-	
			AVG = .23		= 0		= .15		
7	2600	PROTECTED, SHORE MODIFIED							White City
8	13000	0	180	2.90	-	-	180	1.86	
		1000	175	2.82	-	-	175	1.80	
		2000	175	2.82	-	-	175	1.80	
		3000	175	2.82	-	-	175	1.80	
		4000	40	.65	-	-	40	.41	
		5000	35	.56	-	-	35	.36	
		6000	75	1.21	-	-	75	.77	
		7000	30	.48	-	-	30	.31	
		8000	115	1.85	-	-	115	1.19	
		9000	75	1.21	-	-	75	.77	
		10000	165	2.66	25	.71	190	1.96	
		11,000	95	1.53	5	.14	100	1.03	
		12,000	30	.48	35	1.0	65	.67	
		13,000	30	.48	70	2.0	100	1.03	
			AVG = 1.61		= 0.28		= 1.13		
9	32,600	PROTECTED, SHORE MODIFIED							CLEVELAND
10	7000	0	20	.32	35	1.0	60	.62	
		1000	65	1.05	-	-	65	.67	
		2000	45	.73	15	.43	60	.62	
		3000	45	.73	40	1.14	85	.88	
		4000	80	1.29	25	.71	105	1.08	
		5000	140	2.26	45	1.29	185	1.91	
		6000	80	1.29	20	.57	100	1.03	
		7000	25	.40	15	.43	40	.41	
			AVG = 1.01		= .70		= .90		

BY .....DATE ..... SUBJECT ..... SHEET NO. 5 OF 5

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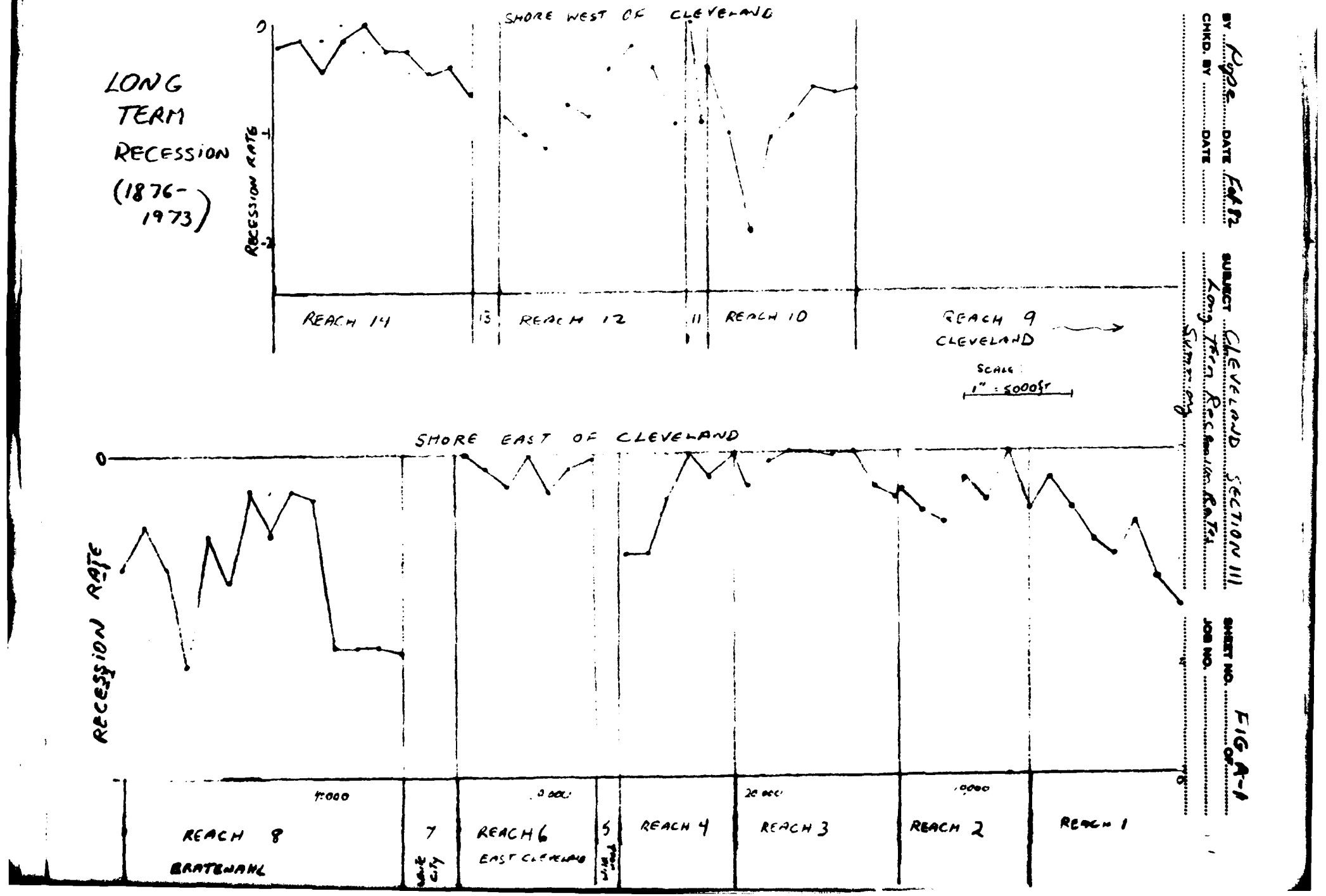
TABLE A-2 (CONTINUED)

REACH	LENGTH	PROFILE	(62 yr) 1876-1938 recession	rate	(35 yr) 1938-1973 recession	rate	(97 yr) 1876-1973 recession	rate	
11	1000	250	65	1.05	25	.71	90	.93	Bramley Estate
		750	-	-	-	-	-	-	
			AVG =	.52		= .36		= .46	
12	8700	500	65	1.05	25	.71	90	.93	
		1500	25	.40	15	.43	40	.41	
		2500	20	.32		-	20	.21	
		3500	40	.65	-	-	40	.41	
		4500	65	1.05	20	.57	85	.88	
		5500	75	1.21		-	75	.77	
		6500	80	1.29	35	1.0	115	1.19	
		7500	75	1.21	25	.71	100	1.03	
		8500	55	.89	30	.86	85	.88	
			AVG =	.90		.48		= .75	
13	1400	PROTECTED, SHORE MODIFIED							
14	9300	0	40	.65	25	.71	65	.67	
		1000	40	.65	-	-	40	.41	
		2000	45	.73	-	-	45	.46	
		3000	25	.40		-	25	.26	
		4000	25	.40	-	-	25	.26	
		5000	-	-	-	-	-	-	
		6000	15	.24	15	.43	15	.15	
		7000	20	.32	20	.57	40	.41	
		8000	15	.24	-	-	15	.15	
		9000	20	.32	-	-	20	.21	
			AVG =	.40		= .17		= .30	


LONG TERM RECESSION (1876-1973)
SHORE WEST OF CLEVELAND
0
RECESSION RATE
REACH 14
13
REACH 12
11
REACH 10
REACH 9
CLEVELAND
SCALE
1" = 5000ft
SHORE EAST OF CLEVELAND
0
RECESSION RATE
REACH 8
BRATENAHL
7
REACH 6
EAST CLEVELAND
5
REACH 4
REACH 3
REACH 2
REACH 1
BY ..... DATE ..... SUBJECT CLEVELAND SECTION III
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JOB NO. .....
FIG A-1

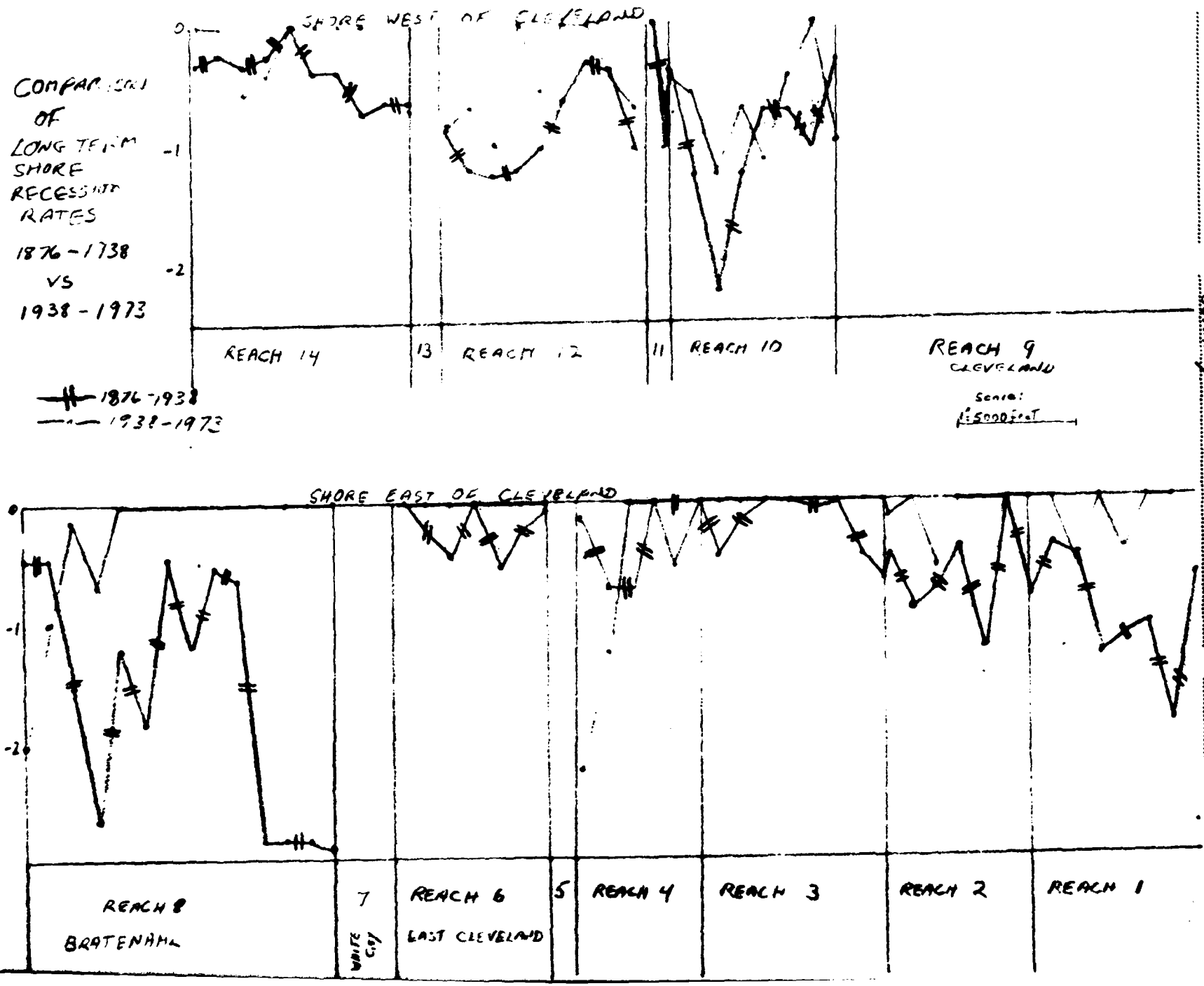

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FIG 4-8

by the updrift construction of these two major coastal structures and subsequent littoral drift starvation. The higher recession rates near the Lake-Cuyahoga County line illustrate a bluff instability reflecting ground water seepage problems which increases even more toward the east and into Lake County. The higher erosion in this area also reflects less population stress on the shore, consequently a general lack of significant shore protection works.

Thus, only Reach 8 and a portion of Reach 10 exhibit an abnormal recession rate which cannot be readily explained. Both areas are characterized by high unstable bluffs with some forms of shore protection (i.e., permeable groins at Perkins Beach and submerged breakwaters and seawalls at Bratenahl) and a higher recession rate (over 1 ft/yr) prior to 1938. Two possible man-made causes of erosion can be advanced for both these areas. One is the presence of a downdrift sediment trap (White City Park-Sewage Treatment Plant at the east end of Bratenahl and Edgewater Park immediately east of Perkins Beach). Littoral material moving alongshore toward the east goes behind the offshore protective works and is no longer available for alongshore transport. This not only adversely effects downdrift beaches but also updrift beaches as the material would ordinarily be available to wave climate reversals for return to the updrift shore. The presence of a downdrift sediment trap can become significant along shores where the net alongshore movement is small because of a general lack of material and a small ratio between dominate and reversal drift potential. This is the case in both subject areas. The other potential man-made influence to these two shores is the Federal Harbor Project.

As a result of the recession rate analysis, only Reach 8 and part of Reach 10 (the Perkins Beach groin field and 800 feet to the west), were identified as study areas to be further evaluated to determine the potential impacts of the Federal Harbor on shore erosion.

A4. POTENTIAL SHORE IMPACTS OF CLEVELAND HARBOR

As discussed in the previous section, direct computations of shore recession impacts attributable to the Federal Harbor is not possible. Therefore, in order to evaluate only Federal responsibility for the erosion climate of Reaches 8 and 10, an analysis of the possible Federal causes of erosion was developed. There are five potential modes by which the Federal Harbor Project could have had an adverse impact on adjacent shores. There is sufficient field data and observations available to develop the rationale by which all but one of these potential causes can be eliminated from further consideration.

a. The Cleveland Harbor Breakwater System could interrupt the alongshore moving sediment by trapping material on the updrift side, thus depriving the downdrift shores of their normal sediment supply.

Statistically, hindcast data for Cleveland (Saville, 1953; WES Contract Report H-74-1, 1974) indicates a very slight net dominance of west to east littoral transport. This is further supported by examining sand buildup offsets at stickout features along the Cuyahoga County shore. Maps of the Cuyahoga River mouth from 1839, 1853, and 1895 show sand fillet buildup both

east and west of the river piers, again with a slight dominance to the west side fillet (1853 shoreline shows 50-foot wide fillet on the west side and a 30-foot wide fillet on the east side). The west breakwater shore arm of the present harbor is abutted on the west side not by a major fillet such as the case with Fairport or Ashtabula Harbors but by Edgewater Park Marina which is constructed of landfill and breakwater structures. 1938 aerial photographs were flown prior to the major filling operations at Edgewater Park but after construction of the offshore breakwater. These photos show no significant sand buildup other than a small pocket beach at the west side of the Edgewater Park structures. Turn of the century maps also show only minimal levels of buildup with more material on the east side of the shore arm, inside the harbor, then on the west side. The lack of sand buildup on the west side of Cleveland Harbor is understandable considering that the area west of Cleveland is geologically a poor source for littoral material as it is dominated by shale bluffs. Thus, there is not a strong net alongshore dominance, nor significant quantities of sand available, nor evidence of littoral transport blockage. It is, therefore, reasonable to conclude that the Cleveland Harbor structures (neither as piers nor as a breakwater) have not significantly blocked the west to east moving littoral material.

b. The Cleveland Harbor Breakwater system could trap material at the open east end during periods of east to west transport permanently removing sand from the littoral system.

During the various phases of East Breakwater construction, littoral material probably has moved westward along the eastern shore during periods of reversals with resultant entrapment of material behind the breakwater. There the material would be permanently trapped and no longer available for return to the eastern shore. This process has not been feasible since the 1926 construction of the Doan Brook Flume and breakwater by the city of Cleveland. The Doan Brook Flume was a major stickout structure (located at the site of the present Cleveland Dike 14) which extended over 1,000 feet out into the lake from 1926 through the 1960's when it was replaced by an L-shaped fill structure projecting from the Gordon park shore. During the period prior to 1926 when beach building material could feasibly enter Cleveland Harbor from the east, the quantities involved were apparently not significant. Examination of maps from the late 1800's through the early 1900's show only a few minor pocket beaches on the east side of shore developments within the harbor. The many landfill operations in Cleveland Harbor associated with airport, dock, marina, and port facility construction have extended the Cleveland Harbor shore 1,000 or 2,000 feet or more lakeward of its natural position, incorporating any preexisting sand pockets within the fill facilities. These many non-Federal shore facilities have interrupted and trapped westward moving material far more directly and completely than would a low, frequently overtopped, breakwater structure which is approximately 3,000-foot offshore

In order to check on the possibility that littoral material may have been trapped in the harbor sediments offshore of the developed shoreline, EPA sediment sample results from 1977 and Corps of Engineers subsurface exploration results from 1977 and 1978 were examined. These sediment data sets provide excellent documentation of the harbor sediments both laterally and with

depth. The only evidence of surface sand or sand within the shallow depth of burial associated with recent littoral processes is at the arrowhead entrance lakeward of, west of, and just inside the west arrowhead breakwaters; east and lakeward of the East Breakwater; and just east and west of the Cuyahoga River piers. The deposits in the vicinity of the West Arrowhead Breakwater and east of the East Breakwater are in 30-foot plus water depth and almost one-half mile from shore. These deposits were created by probably deepwater processes beyond and, therefore, were not influenced by the harbor structures. The silty sand deposits abutting the Cuyahoga River piers are remnants of the original Cuyahoga River mouth sandbar and the fillets which bracketted the original piers. There is no evidence that littoral material has been trapped at the east side of the harbor due to the Federal breakwater and no possibility that this could have occurred over the last 50 plus years because of the generations of Doan Brook-Gordon Park Structures.

c. The Cleveland Harbor Breakwater system could reduce the quantity of material available to the system by sheltering over 5 miles of bluff face from recession thus removing a potential source of littoral material.

Bluff recession from 5 miles of 60-foot high glacial till bluff would probably have added over 13,000 cubic yards of sand-sized material a year to the littoral system assuming 1.0 ft/yr erosion rate and 22 percent of the bluff material was sand. However, recession of this bluff is only indirectly halted by the offshore breakwater. The numerous non-Federal shore structures and landfill operations along the Cleveland Harbor shore have directly curtailed all bluff recession. The Federal breakwater system provided the atmosphere for private and local waterfront development but did not cause bluff recession to cease.

d. The Cleveland Harbor structures could modify the local wave climate via reflection or diffraction to cause wave energy concentration or generate current pattern constrictions which effect a very localized stretch of shore.

The harbor structure configuration and the pattern of higher erosion described in the previous section for Reaches 8 and 10 strongly suggest that this is not the case. Any reflection or diffraction around the West Breakwater shorearm is blocked by Edgewater Park and Marina and the East Breakwater Head Section is so far offshore that impacts on the wave climate (particularly considering the short period waves of Lake Erie, i.e., an 8-second wave would have a wave length of 328 feet), would have dissipated long before reaching the shoreline.

e. The annual dredging of the Cuyahoga River and disposal of this material lakeward of the harbor breakwaters or in confined diked disposal sites has permanently removed a quantity of sand-sized material from the littoral system.

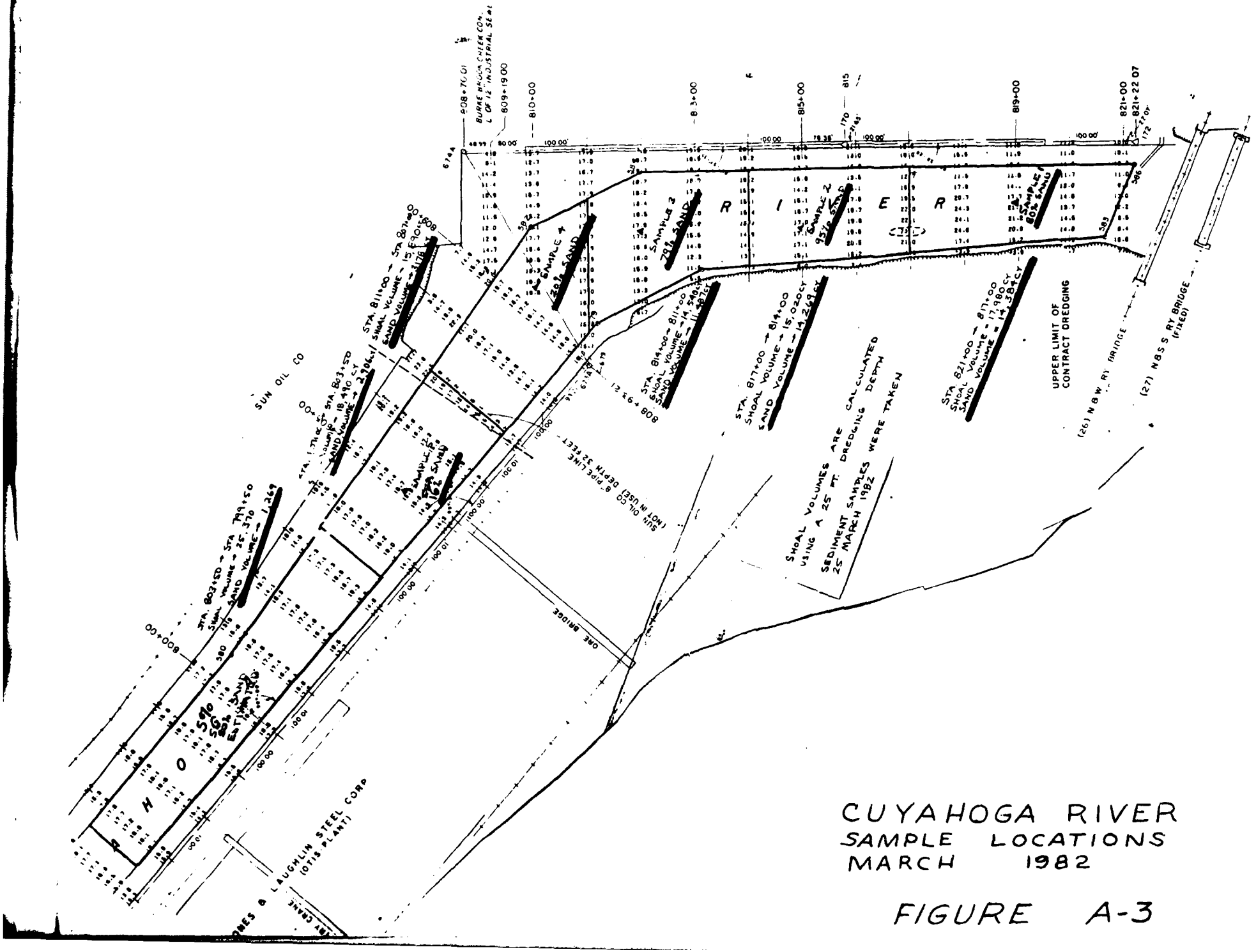
Loss of sand and gravel from the littoral system due to the annual dredging of the fluvially supplied sediments is the only identifiable impact of the Federal harbor on shoreline recession rates. Annual maintenance dredging removes the potential littoral load which had been carried by the Cuyahoga River and deposited in the Federal channel. Since 1898, the material dredged

has been placed beyond the nearshore zone. In 1898 disposal practices were changed from dumping off of the East 9th Street road end to offshore of the newly constructed East Breakwater. Until 1937, dredging of the Cuyahoga River was accomplished by private interests for private development. Since that time the Federal Government has removed the river sediments as a Federally authorized project. During the 1950's much of the upper Federal Channel portion of the Cuyahoga River dredging were used as fill in the harbor to build the area which would later become Burke Lakefront Airport. Since the early 1970's all dredged material from the Cuyahoga River has been disposed of in confined diked disposal areas. In order to evaluate the impact of this permanent removal of sand and gravel, it is necessary to quantify the volume of material involved and to develop a sediment budget which would predict the shoreline distribution of this sediment without a Federal project. The following sections develop the information required to evaluate the impact of the Federal harbor dredging and sand removal on the two previously identified potential impact areas.

A5. SAND AND GRAVEL LOAD OF THE CUYAHOGA RIVER

Field observations, theoretical calculations, and data collected during this study indicate that a quantity of sand-sized material does travel down the Cuyahoga River and is deposited in the upper portions of the Federal channel. Here the Cuyahoga River, particularly during periods of high discharge, quickly experiences an increased channel cross section and enters the lake effect zone resulting in a rapid loss of flow velocity and localized deposition of the sand-sized portion of the suspended sediment load. There is little evidence that any quantity of sand makes it beyond the original deposition basin between dredging. Prior to dredging activities in the Cuyahoga, the sand-sized material would have continued to buildup in the river channel, eventually reaching the lakeshore. In a balanced condition the input of sand to the river channel would average out through time to equal the quantity which the river feeds out to the lake.

The presence of some sand deposits in the upper Cuyahoga is known but not quantified. In order to determine an average annual sand-sized sediment supply to the shore two approaches could be practically taken: what is the average annual sand yield of the Cuyahoga and what is the quantity of sand annually deposited and removed by dredging? The computations and results are presented on the following pages (pages A-9 to A-11). The first approach involves computations made to document a long period of time based on measured flow data and suspended sediment yield (Methods 1 and 2). The second approach can be directly measured but without historical sediment sampling any measurements are representative only of the year collected (Method 3 and Figure A3). Therefore, we can predict long-term sediment supply based on theory or measure 1 year's sediment supply based on actual surveys and samples. Both approaches were taken and the results were comparable (ranging from 38,200 to 48,200 cubic yards per year) suggesting that both the theories were reasonable and the 1 year of survey and sample data was representative of the average year. For the purposes of this study, a value of 45,000 cubic yards per year was selected as the average annual fluvial yield of potential littoral material to the lakefront without dredging.


CUYAHOGA RIVER
SAMPLE LOCATIONS
MARCH 1982
FIGURE A-3
SHOAL VOLUMES ARE CALCULATED USING A 25 FT. DREDGING DEPTH
SEDIMENT SAMPLES WERE TAKEN 25 MARCH 1982
UPPER LIMIT OF CONTRACT DREDGING
SUN OIL CO
SUN OIL CO 8" PIPE LINE (NOT IN USE) DEPTH 32 FEET
ONE BRIDGE
(26) N B & W RY BRIDGE
(27) N B & S RY BRIDGE (FIXED)
J. L. ONES & LAUGHLIN STEEL CORP (OTIS PLANT)
R I E R
SAMPLE 1 28% SAND
SAMPLE 2 95% SAND
SAMPLE 3 78% SAND
SAMPLE 4 28% SAND
SAMPLE 5 60% SAND
SAMPLE 6 16% SAND
STA. 811+00 – STA. 807+00 SHOAL VOLUME – 15,570 CY SAND VOLUME – 3,178 CY
STA. 807+50 – STA. 803+50 SHOAL VOLUME – 18,490 CY SAND VOLUME – 2,304 CY
STA. 803+50 – STA. 799+50 SHOAL VOLUME – 25,370 SAND VOLUME – 1,269
STA. 814+00 – 811+00 SHOAL VOLUME – 14,540 CY SAND VOLUME – 11,275 CY
STA. 817+00 – 814+00 SHOAL VOLUME – 15,020 CY SAND VOLUME – 14,269 CY
STA. 821+00 – 817+00 SHOAL VOLUME – 17,980 CY SAND VOLUME – 14,384 CY
808+76.01
809+19.00
810+00
813+00
815+00
819+00
821+00
821+22.07
800+00
12 x 6 + 808

A6. LITTORAL TRANSPORT QUANTITIES

Sediment available for littoral transport can enter the nearshore system from river input, onshore movement of offshore sands, and bluff recession. As discussed previously the suspected impacts of the Federal harbor is confined to a denial of river input sands to the littoral system. The bluff natural area in Cleveland Harbor is totally protected by non-Federal works and landfill areas and there is no evidence of an offshore source of sand. The sediment budget evaluation for the potential impact areas (i.e., Reach 8 and part of Reach 10) only needs to address those items of the budget necessary to identify Federal responsibility.

The relative east or west distribution of the fluvial yield of sand to the lake shore was computed based on an evaluation of the wave energy per littoral transport direction. This was computed from Saville, 1953 "Wave and Lake Level Statistics for Lake Erie," BEB TM No. 37, Statistical Energy Data Per Direction for Ice-Free Period for Cleveland, OH and with the use of the method outlined in the Shore Protection Manual (i.e., Equations 4-26 and 4-42). The ice-free period data were selected for use as they better represent the wave climate experienced by sediment discharged into the lake from a river. The data were compiled and weighted according to the wave approach angle with the shoreline. This evaluation suggests that 56 percent of the wave energy comes from a westerly direction (promoting easterly drift) and 44 percent comes from an easterly direction (promoting westerly drift). If the Cuyahoga River littoral contribution is 45,000 cubic yards per year then the net drift of this material to the east is approximately 25,200 cy/yr and the net drift to the west is approximately 19,800 cy/yr. Assuming 20 percent of this material would be lost offshore, the effective transport to the east is 20,160 cy/yr and to the west it is 15,840 cy/yr (Fig. A-4).

The material which is transported to the east would be distributed over the 7.6 miles of shore from the mouth of the Cuyahoga to White City Park/105th Street Sewage Treatment Plant if all the Federal harbor structures and non-Federal shoreline works were not in existence. Obviously, without the Federal harbor structures or Federal dredging the non-Federal shoreline structures would probably not exist in their present form. This would be equivalent to 0.5 cubic yard of sand per linear foot of shore for each year (Fig. A-4).

The material which is transported to the west would be distributed over the 3.0 miles of shore from the mouth of the Cuyahoga to Bramley Beach if all Federal harbor structures and non-Federal structures, including Edgewater Park, were not in existence. This would be equivalent to 1.0 cubic yards of sand per linear foot of shore for each year(Fig. A-4).

A7. IMPACTS TO THE BRATENAHL SHORE

The Bratenahl shore is 2.4 miles long or 12,672 feet and the predicted annual effect of the Cleveland Harbor dredging to this shore is 0.5 cy/ft X 12,672 ft or 6,336 cubic yards per year. This appears to be a small quantity of material but it has been annually denied to the shore since 1898, adding up to approximately 500,000 cubic yards. However, only since 1937 has there

BY Pope DATE 10 June 82 SUBJECT Annual Sand and Gravel Load of the Cuyahoga River Cleveland Hbr III Study SHEET NO. ..... OF .....
CHKD. BY ..... DATE ..... JOB NO. .....

SUMMARY OF CALCULATIONS AND REAL DATA

Three methods were employed to determine the Annual Sand Discharge of the Cuyahoga River. These Methods are presented in the following sheets. Methods 1 and 2 are computed from published discharge data to represent long term averages. Method 3 is based on the sampled March 1982 sand content of the upper portion of the Federal channel and represents one years data

Method 1 = 38,200 cubic yards of sand/yr

Method 2 = 48,200 cubic yards of sand/yr

Method 3 = 47,500 cubic yards of sand/yr

For the purposes of the Cleveland Harbour III Study a value of 45,000 cubic yards per year as the average annual fluvial yield of potential littoral material was selected.

METHOD 1

Simplistic calculation of average sand yield based on data presented in: Pincus (1960) "Engineering Geology of the Ohio Shoreline of Lake Erie," Technical Report No. 7, Sheet E, Ohio Department of Natural Resources - Geologic Survey

Cuyahoga River Drainage Area = 813 sq mi

Avg yield = 0.99 cfs/sq mi

Average Suspended Sediment load = 260,463 tons

Average Composition of sed load based on average till material of basin
= 26% clay
52% silt
22% sand

∴ Avg sand yield of basin = 260,463 tons x 0.22 = 57,302 tons

or 38,201 cubic yards

BY Pope DATE June 82 SUBJECT Computation of Sand Load Discharges for the Cuyahoga Cleveland III Study SHEET NO. 1 OF 3

CHKD. BY ..... DATE ..... JOB NO. .....

METHOD 2

Computation of Sand Load at Independence OH using a "Flow Interval method" To Determine Average Annual Littoral Material Discharge For The CUYAHOGA RIVER.

Discharge records in CFS for the Cuyahoga R. at Independence were examined from 1922 through 1980 and grouped into classes of discharge. The total number of days in each discharge class was determined. From the total 58 years of record an average water year was defined by reducing the total number of days per discharge class to a number of days in a single year (Columns (2) and (3) of Sheet 3)

To determine the total suspended sediment load and the total sand load relative to each discharge class, USGS Water Resource Data Records for the Cuyahoga R. at Independence were examined. Between 1964 and 1980 two or more suspended sediment samples were taken per year and grain size analysis performed (Sheet 2). Total Suspended Sediment Discharge and Suspended sediment discharge for material coarser than 0.062 mm (i.e. sand sized) in tons per day was computed from the known records. (Columns (1) and (2) of Sheet 2). This data is grouped as a known instantaneous discharge (Column (1) of Sheet 3) relative to a discharge class and presented on Sheet 3. The Average Load (Columns (5) and (8)) and Standard error (Columns (6) and (9)) per discharge class was computed and multiplied by the number of days (Column 3) to determine the total annual quantity of suspended load and of sand load discharge.

Using this procedure, the Average Annual Sand Discharge for the Cuyahoga is 48,200 cubic yards with an error range between 37,400 and 59,100 cubic yards (using a 1.5 conversion factor for cubic yards to tons).

BY Pope DATE Jan 82 SUBJECT Particle-Size Distribution of Suspended Sediment - Station 04208000 SHEET NO. 2 OF 3

CHKD. BY ..... DATE ..... JOB NO. .....

US GS Water Resources Data for Ohio

Station 04208000 CUYAHOGA RIVER AT INDEPENDENCE, OH

YEAR	DATE	TIME	INSTANTANEOUS DISCHARGE (CFS)	SUSPENDED SEDIMENT (MGA)	(1) SUSPENDED SEDIMENT DISCHARGE (Tons/day)	SUSPENDED SEDIMENT % COARSER THAN 0.062 mm	(2) SAND DISCHARGE (Tons/day)
1964	MARCH 5	0630	12200	2380	78,300*	4%	3132
1964	APR 21	1800	5600	3360	50,700*	11%	5577
1965	Feb 12	1520	4170	764	8,600*	12%	1032
1965	JUNE 1	1800	382	2670	2,800*	4%	112
1965	JULY 3	0730	804	3280	7,100*	1%	71
1965	OCT 10	0930	1150	844	2,600*	4%	104
1966	FEB 11	0950	7280	746	14,600*	3%	438
1966	MARCH 12	1745	1240	1660	5,600*	12%	672
1966	APR 28	1005	4220	1380	15,700*	5%	785
1968	NOV 15	1800	924	1170	3670	9%	330
1968	DEC 28	1520	11,200	1020	30,800	7%	2156
1969	APR 5	1500	7100	3100	59,400	1%	594
1969	MAY 19	1350	10,000	1220	32,900	12%	3948
1969	OCT 2	1340	1140	2360	7260	6%	436
1970	APR 2	1515	3720	1040	10,400	1%	104
1970	SEPT 25	1150	1200	868	2,810	5%	140
1970	OCT 13	1300	5170	345	4,820	0%	0
1971	JUNE 21	1800	2340	862	5,450	0%	0
1971	JULY 24	1530	880	897	2130	1%	21
1971	Dec 30	1730	4680	1240	15700	9%	1413
1972	Feb 15	1500	1660	813	3690	4%	148
1972	MARCH 13	1615	4680	1400	17,700	18%	3186
1972	APR 15	1900	8130	1070	23,500	4%	940
1972	JUNE 23	1740	6010	1080	17,500	9%	1575
1972	Sept 26	1345	1650	720	3,210	9%	289
1972	DEC 6	1530	4950	1370	18,300	11%	2013
1973	MAR 15	1300	4150	813	15,700	12%	1884
1973	APR 27	2000	2960	906	7,240	14%	1014
1973	JUNE 4	0735	3530	1090	10,400	12%	1248
1973	Nov 26	1430	1310	132	467	14%	65
1974	JAN 20	1415	4360	545	6420	26%	1669
1974	Feb 22	1145	1820	561	2760	14%	386
1974	MAR 10	1330	5540	568	8500	21%	1785
1974	APR 2	1300	5870	1800	28,500	9%	2565
1977	Feb 24	1645	7330	1710	33,800	7%	2366
1977	MAR 2	1115	4960	1140	15,300	6%	918
1977	DEC 14	0730	8290	2100	47,000	12%	5640
1978	MAR 27	0715	5920	941	15,000	8%	1200
1978	MAY 24	0735	4380	1940	22,900	8%	1832
1979	AUG 28	0730	3500	2090	19,800	3%	594
1980	MAR 21	1645	6100	1930	31,800	10%	3180
1980	AUG 12	0735	1610	710	3,090	3%	93

* computed using .002697 conversion factor: tons/day = mg/l × cfs

BY Rapp DATE 1/28/81 SUBJECT Suspended Sediment Transport
CHKD. BY ..... DATE ..... by the Cunningham Regression Method
SHEET NO. 5 OF 7
JOB NO. .....

(1) Q_w Instantaneous Discharge (CFS)	(2) Interval Discharge (CFS)	(3) N_i Number of Days (out of 365)	(4) Q_{ss} Suspended Sed Discharge Tons/day	(5) L_{ss}* Avg Load	(6) $(s_{L_{ss}})$* Stand Error	(7) Q_s Sand Discharge Tons/day	(8) L_s* Avg Load	(9) (s_{L_s})* Stand Error
382 804	0-820	254.5	2800 3280	3040	240	112 71	91.5	20.5
880 924	820-990	18.4	2130 3670	2900	770	21 330	175.5	154.5
1140 1150	990-1199	18.2	7260 2600	4930	2330.	436 104	270.0	166.0
1200 1240 1310	1199-1500	18.8	2,810 5,600 467	2959	1484	140 673 65	292.3	191.1
1610 1650 1660 1820	1500-2100	22.5	3,090 3,210 3,690 2,760	3188	143	93 269 148 386	229.0	66.7
2340 2960 3500 3530 3720	2100-3800	23.7	2,450 7,240 19,800 10,400 10,400	10658	2475	0 1014 594 1548 104	592.0	244.7
4170 4220 4360 4380	3800-4600	3.6	8,600 15,700 6,480 22,900	13405	3734	1032 785 1669 1832	1329.5	250.5
4680 4680 4950 4960 5170 5540 5600	4600-5600	2.3	15,700 17,700 18,300 15,300 4,820 8,500 50,700	8717	5654	413 3186 2013 918 0 1785 5577	2127.4	684.0
5870 6920 6010 6100	5601-6800	1.8	28,500 15,000 17,500 31,800	23200	4101	2365 1200 1575 3180	2130.0	453.2
7100 7150 7280 7380 8130	6800-8100	0.7	59,400 13,700 14,600 38,800 23,500	29,100	8249	594 1884 434 2366 940	12436	3768
8290 10,000 11,300 12,200	8100-∞	0.5	47,000 32,900 30,800 78,300	41,250	10,957	5640 3948 2156 3132	3719.0	732.7

$\bar{L}_{ss}$ = 4038
VV = 2797
$\sigma_{L_{ss}}$ = 3229 → 4498.1
1.645 $\sigma_{L_{ss}}$ = 4626.1
$\frac{1.645\,\sigma_{L_{ss}}}{\bar{L}_{ss}}$ = .11

AVG ANNUAL SUSPENDED SED LOAD
= 1,473,979.5 Tons
Range 1,305,933 to 1,641,025

$\bar{L}_s$ = 1982
VV = 4704
σ_{L_s} = 1525 → 2430
1.645 σ_{L_s} = 4447
$\frac{1.645\,\sigma_{L_s}}{\bar{L}_s}$ = 2.2

AVG ANNUAL SAND LOAD
= 72343 Tons (49.1%)
Range 56119 to 88585 Tons
(37913 cy) to (59,100 cy)

* NOTE: Avg Load (mean) and Standard Error computed using Hewlett Packard 19P65 and Standard Pac Program STD-029

BY ..... DATE 10 June 82 SUBJECT Volume of Sand Sized Material in Upper reaches of the Federal Cuyahoga River

CHKD. BY ..... DATE .....

SHEET NO. ..... OF .....

JOB NO. .....

METHOD 3

Qualitative field evidence including the observations made during past dredging operations suggested that the upper portion of the Federal dredged Cuyahoga River contains significant quantities of sand-sized material. Prior to the Spring 1982 dredging, a sampling program was undertaken to document the presence and quantity of sand-sized material which had collected between Stations 821 and 790 since last dredging (Spring 1981). Observations made during previous maintenance dredging programs and the results of EPA sampling programs strongly suggest that no quantity of sand sized material is transported further downstream than this designated reach.

Samples were obtained from the approximate midchannel location at Stations 819, 815, 812, 810, and 805 on 25 March 1982 using the Tug STANLEY and Derrickboat TONAWANDA. A clam bucket was dropped in midchannel and a 4- to 7 foot thick sample was lifted to the derrickboat deck where a representative sample could be collected from the bucket. Grain size analysis was completed on each sample.

The sand bearing channel length was subdivided into areas represented by each sample. The volume to be dredged from each area was multiplied by the percentage of sand-sized material to determine the quantity of sand which had collected in the channel settling basin.

Following computations are based on Cuyahoga River before dredging soundings (April 1982), a specified dredging depth of 25 feet, and the March 1982 sediment sample results:

SAMPLE	REACH (STATIONS)	SHOAL VOLUME (CY)	PERCENT SAND	SAND VOLUME (CY)
1	821 - 817	17,980	80%	14,384
2	817 - 814	15,020	95%	14,269
3	814 - 811	14,540	79%	11,487
4	811 - 807	15,890	20%	3,178
5	807 - 803+50	18,490	16%	2,958
	803+50 - 799+50	25,370	5%	1,269
TOTAL		107,290		47,545 CY

BY Pope DATE 11June'62 SUBJECT Cleveland Harbor Sect 111
CHKD. BY .... DATE .... Sediment Budget impacts
SHEET NO. .... OF ....
JOB NO. ....

SEDIMENT BUDGET FOR THE FLUVIAL IMPUT TO THE LITTORAL SYSTEM
ASSUMING NO FEDERAL HARBOR (No dredging, No structures)

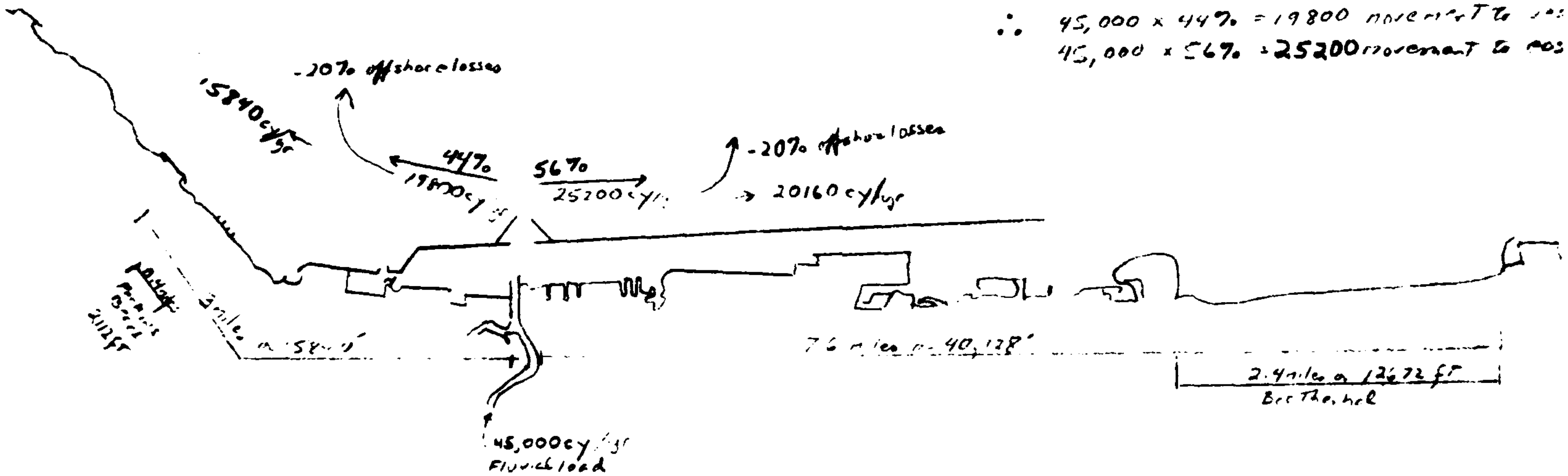
Fluvial Load = 45,000 cy/yr of Sand

computed wave energy flux ratio of east to west movement for an ice free year is:

44% to west and 56% to east

∴ 45,000 x 44% = 19800 movement to west

45,000 x 56% = 25200 movement to east



MOVEMENT TO WEST.

Western Terminus assumed at Bramley Estates which sticks out 300 feet from the shore and therefore is a major block. The approximate 40° bend in the shoreline at Edgewater would limit the western longshore transport and therefore the western cell of the sediment budget is probably shorter than the straight shore eastern cell

3 miles of shore in cell (15,840 ft)

19800 cy/yr of littoral load from the Cuyahoga R -20% offshore loss = 15840

$\frac{15,840 \text{ cy/yr}}{15,840 \text{ ft}}$ = 1.0 cy/yr per linear foot of shore

Littoral Quantity which would annually feed Perkins Beach

0.4 mile impacted (2112 ft) x 1.0 cy/yr per ft

= 2112 cy/yr

MOVEMENT TO EAST:

Eastern Terminus assumed at White City Pier which sticks out approximately 1300 feet from shore and is a total block to along shore movement

7.6 miles of shore in cell (40,128 ft)

25200 cy/yr of littoral load from Cuyahoga River - 20% offshore losses = 20160

$\frac{20,160 \text{ cy/yr}}{40,128 \text{ ft}}$ = 0.50 cy/yr per linear foot of shore

Littoral Quantity which would annually feed Bratenahl

2.4 miles impacted (12,672 ft) x 0.50 cy/per ft

= 6336 cy/yr

Note: This budget is highly conservative because offshore losses due to delta building [illegible] also alongshore addition to the shore system is not linear over a 3 mile or 7.6 mile [illegible] it would be higher near the source and less further from sources.

FIGURE A-4

BY Rpac DATE 14 Sept 82 SUBJECT Cleveland Harbor SHEET NO. ... OF ...
CHKD. BY ... DATE ... Sect III JOB NO. ...
... Summary of Impact Data ...

SEDIMENT BUDGET AND OTHER QUANTITATIVE DATA ON THE IMPACT OF CLEVELAND HARBOR ON THE BRATENAHL SHORE AND PERKINS BEACH

Cleveland - Cuyahoga

Sand and Gravel yield of Cuyahoga = 45,000 cy/yr

Wave Energy Flux Ratio
- ice-free period: 56% to east, 44% to west
- Full year: 67% to east, 33% to west

Annual Fluvial Contribution to the Littoral System
- to the offshore = 20%
- to the east = 20,160 cy/yr
- to the west = 15,840 cy/yr

BRATENAHL SHORE

Length = 2.4 miles (12,672 ft)

Annual Fluvial contribution to the Bratenahl shore littoral System
- rate = 0.5 cubic yards per year per foot of shore
- Total = 6336 cubic yards per year

Total Littoral denial due to River dredging
- 1898 to 1982 (Federal and private dredging - 84 years) = 532,000 cy
- 1937 to 1982 (Federal dredging - 45 years) = 285,000 cy

Recession Rates
- 1876-1938 = 1.6 ft/yr
- 1938-1973 = 0.2 ft/yr
- 1876-1973 = 1.1 ft/yr

Natural recession rate = 1 ft/yr
White City influence = 1.7 ft/yr for 3500 ft at east end (1915 - 1968)
Cleveland Harbor influence = 0.1 ft/yr (includes private shore protection)

PERKINS BEACH

Length = 0.4 mile (2112 ft)

Annual Fluvial Contribution to the Perkins Beach littoral System
- rate = 1.0 cubic yards per year per foot of shore
- Total = 2112 cubic yards per year

Total littoral denial due to river dredging
- 1898 to 1982 (Federal and private dredging - 84 yr) = 177,000
- 1937 to 1982 (Federal dredging - 45 years) = 95,000 cy

Recession rates
- 1876 - 1938: 1.6 ft/yr
- 1938 - 1973: 0.9 ft/yr
- 1876 - 1973: 1.3 ft/yr

Natural recession rate = 0.8 ft/yr (long term)
Cleveland Harbor influence = 0.5 ft/yr

been any Federal involvement in dredging suggesting a total Federally-induced denial of 285,000 cubic yards. This quantity of littoral material cannot be directly related to an increased bluff recession rate without developing a complete sediment budget for the Bratenahl shore. Data does not exist with a sophistication suitable for such a detailed interpretation.

The recession rates for Bratenahl have varied through time in response to natural recession rates, private shore protection efforts, landfill operations, non-Federal structures, and possibly the Federal Harbor. In order to sort out these various factors it is necessary to look at the 1876-1938 recession rate. Extensive landfill operations have reduced more recent recession rates to 0.23 ft/yr mitigating almost all man-induced and natural erosion.

During 1876-1938 the net recession of 1.6 ft/yr included the influence of Cleveland Harbor, private shore protection, natural recession and the White City Park/Sewage Treatment Plant as a downdrift trap. The natural recession rate was determined by examining the recession rate for the same period of time (i.e., 1876-1938) for an area of similar geology with no or limited shore protection and beyond the influence of Cleveland Harbor or other major shoreline structures. Reach 1 meets these criteria and its 1876-1938 recession rate of 1.0 ft/yr is interpreted as representing a natural recession rate.

The trapping effect of the White City Park/Sewage Treatment Plant breakwater was determined by comparing aerial photographs from 1938 to 1968 and computing the quantity of material which had collected during this time period. The original White City Breakwater was constructed about half way between the present shore parallel breakwater and the shore in 1913 and the present configuration was constructed in 1933. In 1968 the trap was sealed when a steel sheet pile wall was driven at the west side connecting the formerly detached West Breakwater with the shore. Thus, the White City Park facility was able to moderately trap material during the 1919-1933 period and dramatically during the 1933-1968 time period. Unfortunately, there is no way to document the amount of material that has been trapped other than for the 1938-1968 period. The quantity of material collected over this 36-year period of time was 41,778 cubic yards or 1,160 cubic yards per year.

The Bratenahl shore recession rate between 1876 and 1938 was significantly higher for the 3,500-foot length immediately west of the White City breakwater (averaging 2.8 ft/yr) than it is for the rest of Reach 8 (averaging 1.1 ft/yr over the other 9,000 feet of shore). This suggests that the White City Breakwater was responsible for an additional 1.7 ft/yr of Bratenahl shore recession which was confined to the eastern end of the village and prior to 1968. Converting this recession rate to a quantity of littoral material which would have been released from the eroding bluff (i.e., 3,500-foot length X 1.7 ft/yr X 25-foot high bluff X 22 percent of bluff material is sand) equals 1,212 cubic yards per year. This value closely approximates the apparent accretion rate in the White City trap.

Therefore, it is reasonable to state that the 2.8 ft/yr erosion rate for the 3,500-foot eastern end represents 1.7 ft/yr of White City induced erosion, 1 ft/yr of natural recession, and 0.1 ft/yr of Cleveland Harbor induced erosion minus the efforts of private shore protection. The shore recession rate for the rest of the Bratenahl shore breaks down similarly, where of the 1.1 ft/yr average recession rate, 1.0 ft/yr is natural recession and 0.1 ft/yr is induced by Cleveland Harbor minus the private shore protection efforts. The existing data does not allow sorting out the protective effects of private structures from the additional recession effects of the Cleveland Harbor project. In addition, private shore protection is part of both the present and the past shoreline status quo. It is reasonable to conclude that private shore protection will continue into the future at a level comparable to or exceeding the present level if no Federal or minor mitigative measures were taken.

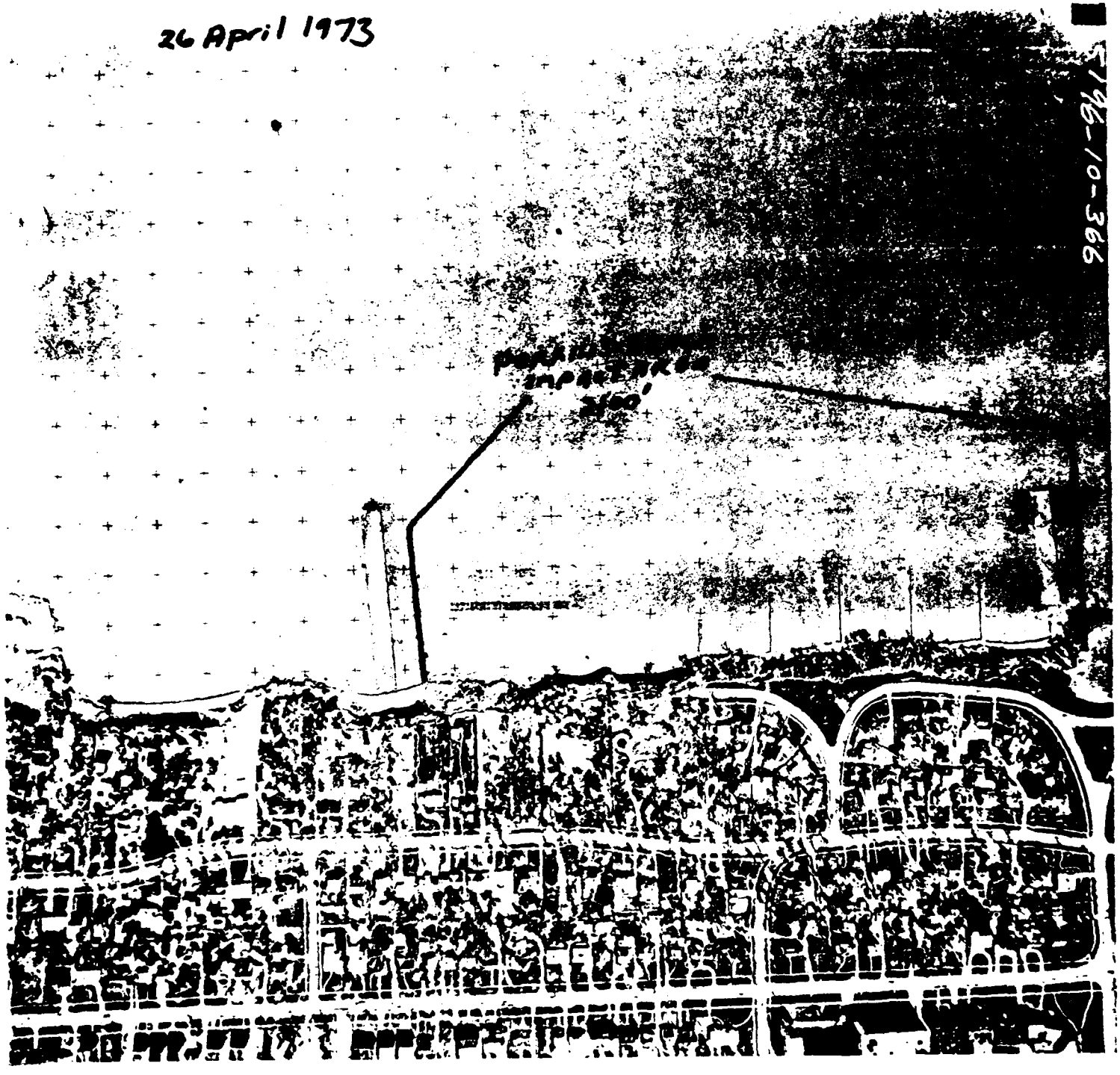
In summary, the increased Bratenahl shore recession induced by the Federal denial of 6,300 cubic yards per year of littoral material is estimated to be 0.1 ft/yr.

A8. IMPACTS TO THE PERKINS BEACH SHORE

The Perkins Beach shore is 0.4 miles long (2,112 ft) and the predicted annual effect of the Cleveland Harbor dredging to this shore is 1.0 cubic yards per foot or 2,112 cubic yards per year (Fig. A-4). For ease of discussion, the impact area within Reach 10 will be called "Perkins Beach" however, the western 800 feet of this impact area is actually private lands. This small quantity of material has been annually denied to the shore since 1898, totalling 177,000 cubic yards. The direct Federal disruption to the system due to dredging has only been in effect since 1937 (when annual dredging was started) totalling 95,000 cubic yards. This quantity of littoral material cannot be directly related to an increased bluff recession rate without developing a complete sediment budget for the shore west of Cleveland. Data does not exist with a sophistication suitable for this detailed interpretation.

The recession rate for Perkins Beach has varied through time in response to natural recession rates, heavy protection to neighboring shores, and recent moderate levels of protection to the subject shore. The Perkins Beach shore is influenced by total protection to the eastern shore and a sand-poor littoral contribution from the shale bluffs to the west. Thus, Perkins Beach is the only "erodable" shore in Reach 10. Since the mid-1940's, the Perkins Beach portion of this impact zone has been moderatly protected by a permeable groin system, and in the 1950's, a large quantity of artificial fill was placed over the bluff face. Although this groin system is not a totally effective form of protection it has had the effect, along with placement of fill, of reducing Perkins Beach erosion rate during the 1938-1973 time period from a 1.6 ft/yr rate in 1876-1938 to 0.9 ft/yr in 1938-1973. The total long-term recession rate (1876-1973) for this 2,000 plus foot section of shore averages 1.3 ft/yr.

Unfortunately, the only study zone reach which can be used to represent the natural recession rate for an unprotected glacial till bluff area is Reach 1,


26 April 1973
196-10-366

which is east of Cleveland, has a slightly different geology, and is characterized by a different shoreline compass orientation. Recession rates for this section of shore are 1.0 ft/yr for 1876-1937, 0.5 ft/yr for 1937-1973, and 0.8 ft/yr for the total long-term period of 1876 through 1973. When comparing the natural recession rate of Reach 1 to the complex recession history of Reach 10, the differences associated with the shoreline orientation and geographic spacing become less significant if averaged over time. Therefore, the long-term (1876-1973) recession rates are used for comparison between the Reach 1 natural recession rate of 0.8 ft/yr and the Reach 10 (Perkins Beach) Cleveland Harbor induced plus natural recession rate of 1.3 ft/yr. The Cleveland Harbor induced recession rate to Perkins Beach is therefore 0.5 ft/yr of additional recession. This ignores the effect of downdrift sediment trapping at Edgewater Park and the west to east drift disruption artificially caused by the Bramley Beach headland, which cannot be isolated. The average annual sediment denials to this shore due to the Federal harbor is 2,112 cubic yards per year.

CLEVELAND HARBOR, OH
SECTION III

APPENDIX B
COASTAL DESIGNS

April 1983

CLEVELAND HARBOR
CLEVELAND, OHIO
SECTION 111

APPENDIX B

ENGINEERING INVESTIGATIONS ALTERNATIVE AND DESIGN

B1. INTRODUCTION

The purpose of this appendix is to provide the appropriate design information and logic for determining plans suitable for further consideration. These plans should be technically feasible, capable of achieving the planning objectives and have a high degree of certainty of achieving their engineering goals. Costs, economic evaluation, and environmental considerations for these plans are provided in the appendices to this report. Particular plans have been eliminated from this process because they do not meet these criteria.

Each considered design will provide the basis upon which the various plans can be compared, in their impact on the NED, EQ, SWB, and RD accounts.

B2. ALTERNATIVE NS

As shown in the Appendix A, only the Bratenahl (Reach 8) and Perkins Beach (Reach 10) areas experience harbor-induced recession rates sufficiently high to warrant consideration mitigation of shoreline damage under Section 111 authority.

The following pages contain design background for Alternatives II through IV for the Bratenahl shore (A) and for the Perkins Beach shore (B). Alternative I, the "No Action" alternative, is used as a base case against which the other alternatives are compared. Although the "No Action" alternative would not satisfy the planning objective to mitigate erosion attributable to the Federal harbor, it must be carried forward in the planning process because it avoids both monetary investments and potential adverse impacts associated with the three other alternatives. The alternative plans considered were:

Alternative IA - Do Nothing - Bratenahl
IB - Do Nothing - Perkins Beach

Alternative IIA - Offshore Disposal Dredged Sand - Bratenahl
IIB - Offshore Disposal Dredged Sand - Perkins Beach

Alternative IIIA - Feeder Beach - Beachfill - Bratenahl
IIIB - Feeder Beach - Beachfill - Perkins Beach

Alternative IVA - Revetment - Bratenahl
IVB - Revetment - Perkins Beach

Alternatives based on land acquisition and groins with beachfill have not been considered. Land acquisition does not satisfy the planning objective as the land will not be protected as defined by DAEN-CWPC letter (7 Jan 81) regarding "Continuing Authorities Policy Issue." Groins with beachfill have been eliminated because this alternative does not have a high degree of certainty in achieving the engineering purpose. Erosion will still occur and without a strong littoral direction, dominance, beach development, and consistent retention cannot be assured. Offshore breakwaters will stop 100 percent of the Federally-induced erosion plus some degree of the natural erosion. They are not 100 percent effective in stopping all erosion. Past Section 111 studies have shown that this alternative is feasible only when public recreational beach benefits can justify the additional expenditures necessary to maintain a beach width. Since the Bratenahl and Perkins Beach reaches do not meet this criterion, offshore breakwaters were eliminated from further consideration.

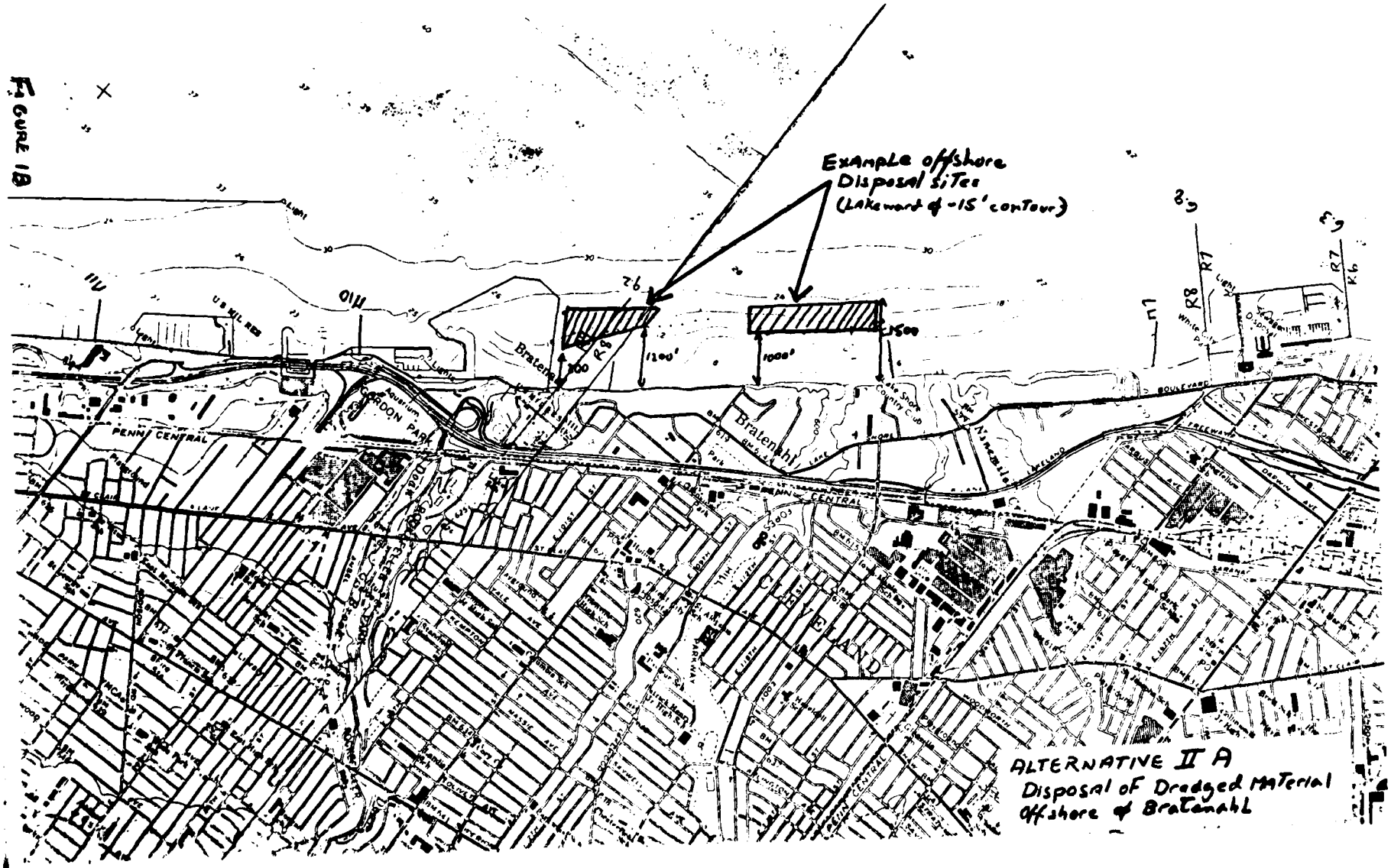
B3. ALTERNATIVES IIA AND IIB - OFFSHORE DISPOSAL OF DREDGED MATERIAL FROM THE CUYAHOGA RIVER

The computed average annual sand and gravel yield of the Cuyahoga River is about 45,000 cubic yards (see Appendix A). However, only the material dredged between Stations 821+00 and 811+00 on the Cuyahoga River is concentrated enough (average 84 percent sand) to justify nearshore disposal with reduced risk of adverse environmental impacts. Therefore of the approximately 47,500 cubic yards of material dredged annually between Stations 821+00 and 811+00, about 40,000 cubic yards are suitable for near-shore disposal.

The most direct and reasonable method of mitigating the Federal harbor impacts to adjacent shores is to divide the sand material dredged from the upper Federal channel of the Cuyahoga River between the two sites where that material would have naturally gone. The disposal pattern for the dredged material should be proportional to the ratio of the quantities which have been denied to the two impacted sites (that is; 2,000 cubic yards from Perkins Beach and 6,000 cubic yards from Bratenahl or a ratio of 1:3). Therefore, of the 40,000 cubic yards of dredged sand (47,500 cy total material), three quarters, or 30,000 cubic yards of sand (35,600 cy total material) should be placed offshore of Bratenahl and one quarter or 10,000 cubic yards of sand (11,900 cubic yards total material) should be placed offshore of Perkins Beach. The location of the Alternative IIA and IIB disposal sites is shown in Figures B-1 and B-2 respectively. Alternative IIA disposal site is located 1,000 to 1,500 feet offshore and the Alternative IIB disposal site is located 1,000 to 2,000 feet offshore. If only 20 percent of the fill placed offshore enters the nearshore littoral system the annual quantity of sand replenishment to Bratenahl is 6,000 cubic yards and to Perkins Beach it is 2,000 cubic yards. This approximately equals the calculated Federal impact due to interruption of the potential littoral contribution of the Cuyahoga River.

Current dredging practices for the material dredged from the upper portion of the Cuyahoga River navigation channel incorporates the use of derrick boats and 1,500 cubic yard dump scows. Even though these scows have the capability

FIGURE 18


Example offshore
Disposal Sites
(Lakeward of -15' contour)
1200'
1000'
Bratenahl
PENN CENTRAL
GORDON PARK
Aquarium
CLEVELAND
ALTERNATIVE II A
Disposal of Dredged Material
Offshore of Bratenahl

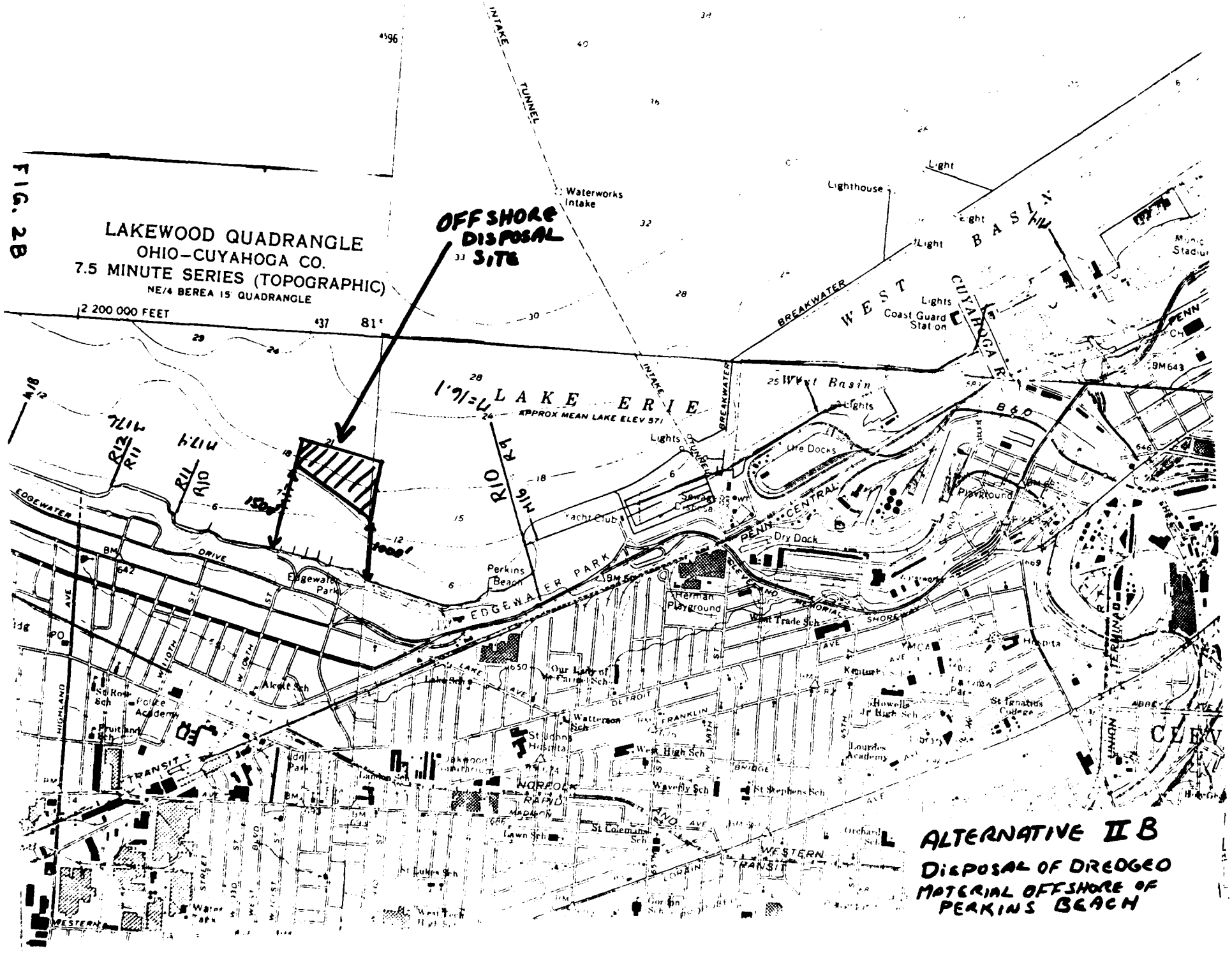


FIG. 2B
LAKEWOOD QUADRANGLE
OHIO–CUYAHOGA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NE/4 BEREA 15 QUADRANGLE
2 200 000 FEET
OFFSHORE DISPOSAL SITE
LAKE ERIE
APPROX MEAN LAKE ELEV 571
INTAKE TUNNEL
BREAKWATER
WEST CUYAHOGA R.
Waterworks Intake
Lighthouse
Light
Lights
Coast Guard Station
West Basin
Ore Docks
Yacht Club
Dry Dock
Playground
Perkins Beach
Edgewater Park
EDGEWATER DRIVE
EDGEWATER PARK
CENTRAL
PENN
Herman Playground
West Trade Sch
Our Lady of Fatima Sch
Lake Sch
Alcott Sch
Police Academy
Fruitland Sch
Watterson Sch
St Luke's Hospital
West High Sch
Wayside Sch
St Stephens Sch
St Coleman Sch
Howells Jr High Sch
St Ignatius College
Lourdes Academy
Lawn Sch
Gordon Sch
Orchard Sch
Water Tank
WESTERN
TRANSIT
NORFOLK AND WESTERN
DETROIT
FRANKLIN
LAKE
HIGHLAND AVE
W 10TH ST
W 65TH ST
W 45TH ST
W 25TH ST
W 117TH ST
BM 642
BM 643
ALTERNATIVE II B
DISPOSAL OF DREDGED MATERIAL OFFSHORE OF PERKINS BEACH

to bottom dump, all the dredged material is presently pumped into the Cleveland Dike Disposal Area No. 14 at Gordon Park. This operation is expensive and ties up the individual scows for some period of time. Diverting the scows for open-lake disposal at the Bratenahl and Perkins Beach sites and using the bottom dumping capability would greatly reduce the round-trip time for each scow. Bottom dumping minimal water depth is 15 feet with 18 feet being the ideal shallowest depth (allowing for some wave action). Therefore, open-lake bottom dumping of the sandy material from the upper Cuyahoga channel is likely to be less expensive than confined disposal for the same material. (See Appendix E for cost savings associated with Alternatives IIA and IIB).

Two major considerations with this attractive Alternative are; whether the toxicity of the subject material is low enough to allow open-lake disposal, (see Appendix D for a discussion of the suitability of the material for open-lake disposal) and whether or not material disposed of in 15-18 feet of water will enter the nearshore littoral system. The degree of onshore transport of offshore placed material is typically minimal in Lake Erie.

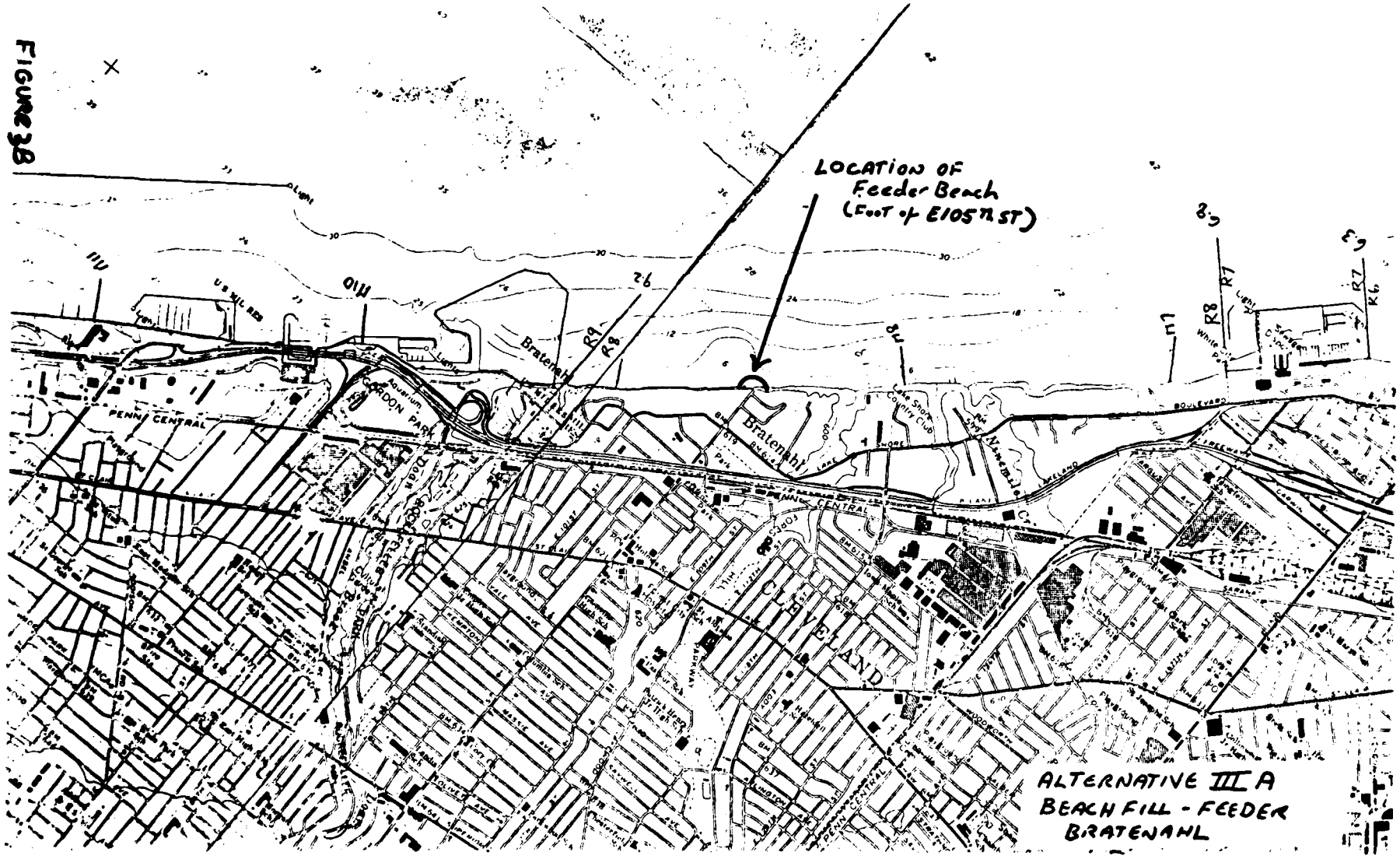
Eventually, with continued offshore disposal, a bar/shoal will develop which will attenuate some of the wave action prior to reaching shore. Shallower disposal or onshore disposal of this material would require extensive rehandling and a dramatic increase in the alternative costs. Should this material be placed in the offshore, it should be monitored to determine the actual mitigation efficiency. Two very attractive aspects of this alternative are the lack of any apparent cost beyond the normal maintenance program and a direct resolution to the Federal responsibility without modifying the present shore. Of course, this alternative will not stop erosion to Reaches 8 or 10. Natural recession and property loss will continue without any major apparent modification. Only the Federally-incurred erosion will be mitigated.

B4. ALTERNATIVES IIIA AND B - BEACHFILL - FEEDER BEACHES

As stated in Appendix A, the Federal harbor project is responsible for denying the Bratenahl shore 6,336 cubic yards and the Perkins Beach shore 2,112 cubic yards of littoral material annually. The interpreted intent of the Section 111 legislation is ". . . not intended that shorelines be restored to historic dimensions, but only to lessen the damages . . ." (ER1105-2-50). Therefore, the simple annual addition of 6,336 cy and 2,112 cy to the littoral system will mitigate the Federal damages. Addition of a quantity of material to replace past losses is interpreted as beyond the authority of Section 111, as it attempts to restore the historic shoreline condition.

As some portion of a placed feeder beachfill will be lost offshore, it will be necessary to annually place some excess material. Assuming that 20 percent of what is placed over the bluff face will be lost offshore, it is necessary to place 7,600 cubic yards annually at Bratenahl and 2,500 cubic yards annually at Perkins Beach to mitigate Federal damages. This material would be purchased commercially or be obtained from some upland source. Placement of the feeder beach will be via truck haul to the bluff edge and

FIGURE 3B


LOCATION OF
Feeder Beach
(East of E105th ST)
ALTERNATIVE III A
BEACH FILL - FEEDER
BRATENAHL
CLEVELAND
Bratenahl
GORDON PARK
PENN CENTRAL

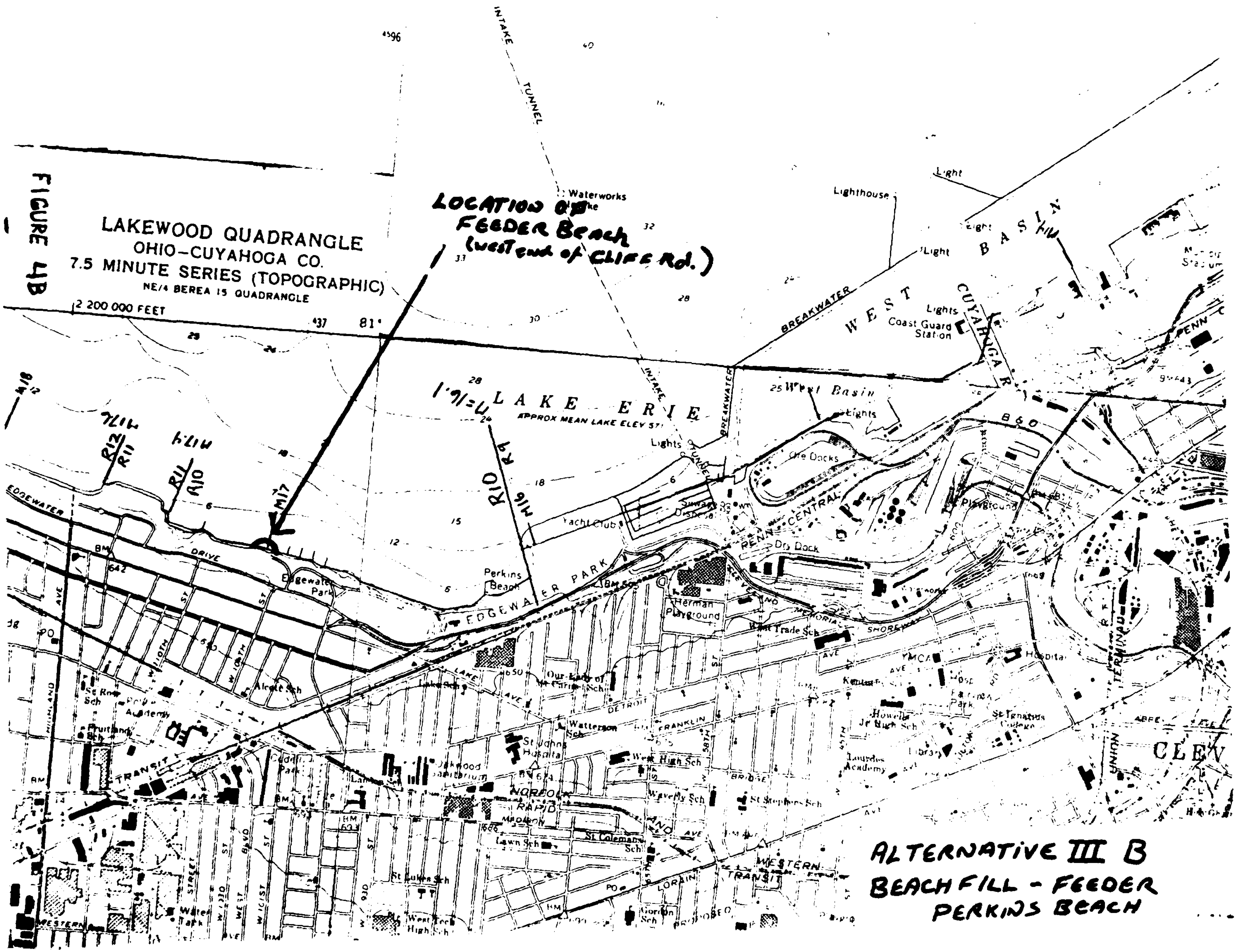

LOCATION OF FEEDER Beach (west end of CLIFF Rd.)
LAKEWOOD QUADRANGLE
OHIO–CUYAHOGA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NE/4 BEREA 15 QUADRANGLE
2 200 000 FEET
LAKE ERIE
APPROX MEAN LAKE ELEV 571
1"=1.6'
INTAKE TUNNEL
Waterworks
Lighthouse
BREAKWATER
WEST BASIN
CUYAHOGA R
Coast Guard Station
West Basin
Ore Docks
Yacht Club
Perkins Beach
Edgewater Park
EDGEWATER PARK
EDGEWATER DRIVE
Herman Playground
Dry Dock
PENN CENTRAL
B&O
M17
M16
R10
R9
R11
R10
M17A
R12
R11
M17B
ALTERNATIVE III B
BEACH FILL - FEEDER
PERKINS BEACH

FIGURE 4B

dumping over the embankment. It may be necessary to lower a small dozer (by crane) onto the feeder beach to spread the material out for access by the wave climate.

The quantity of material involved is small enough that only one feeder beach per site is proposed. Alternative IIIA (Bratenahl) and Alternative IIIB (Perkins Beach) access points are via public easement road ends located toward the updrift (west) end of each site. Alternative IIIA access is at the end of East 105th Street (Fig.B-3) and Alternative IIIB access is at the west end of Cliff Road (Fig. B-4).

As with Alternative IIA and B, this alternative will not stop erosion and it is expected that the quantity of material in the constructed feeder beaches will not remain as an observable unit for any period of time. Natural recession and property loss will continue without any major apparent modification. Only the Federally incurred erosion will be mitigated. The material placed in the feeder beaches will quickly move alongshore and be distributed below the waterline. The presence of vertical-faced shore structures along the Bratenahl shore will minimize above water beach development in this area.

B5. ALTERNATIVES IVA AND B - REVETMENT

A rubblemound revetment constructed along the impacted shore will mitigate all Federally-induced erosion and will completely halt natural erosion for the effective project life of the structure (50 years). The recommended design and generalized cross section is developed in Sheets 1 through 4. The specific cross section throughout each site will vary as local water depths, bluff height, and existing shore protection works vary. The detailed field data necessary for site specific design has not been collected for this stage of alternative development, consequently the generalized design was selected as both typical and conservative.

The Alternative IVA revetment for the Bratenahl shore would extend from the Federal Disposal Dike revetment on the east side of Gordon Park 12,000 feet to the east. It would cover the entire Bratenahl shore and the east end would be inside the west end accretionary tail of the White City Park fillet. This shoreline is irregular and contains a hodge-podge of various protective works. Some structural works may need to be removed or partially disassembled. Two creeks which discharge into the lake along this shore have moderately jettied outlets. The drainage off these creeks will need to be maintained. The revetment will be interrupted at these creeks and tied into the existing jetty structures. Some minor rehabilitation of these jetties may be necessary to assure stability of the revetments. Construction staging and access points would be from the east end at the White City Park/East 140th Street Sewage Treatment Plant (city of Cleveland) and from the west end at Gordon Park (city of Cleveland) or the Navy Finance Center (U.S. Government). The right-of-way at the north end of East 105th Street will be of some limited value but the steep faced high bluff would restrict access. Other construction access would have to be developed via easements through private lands.

The Alternative IVB revetment for Perkins Beach does not need to be extended over the whole 2,000 of impacted bluff as part of this area to the east has been protected and part of this area to the west is a shale bluff. The revetment should extend 1,400 feet west from the western end of the Edgewater Park revetment to the beginning of the vertical shale bluff near the west end of West Cliff Drive. The Perkins Beach groin field will need to be partially removed, particularly at the landward connection for stable placement of the revetment cross section. Some grooming and sloping and seeding of the existing bluff may be necessary. Access and construction equipment stockpiling would be at the public parking lot at the west end of Edgewater Park.

The Federal share of the costs for Alternatives IVA and B equals the cost for Alternatives IIA and B which sets the dollar value for the Federal impacts. Additional funds would need to be developed through a local cooperator.

BY Poyle DATE 30 Jul 81 SUBJECT Cleveland Hbr Section III SHEET NO 1 OF 4
CHKD BY DATE Revetment Design JOB NO
(Alternative IV A and B)

ALTERNATIVE IV A and B

A review of the major design parameters for both the Brathahl and Perkins Beach areas reveal a similar offshore slope, probable similar bluff toe depths, and the critical wave for both sites is a north wave. Therefore one revetment design was developed for both sites.

As the revetment condition is a shallow water wave condition a combination of the highest 10 year wave and the 20 year annual lake level was selected to determine the critical design event.

DESIGN WAVE

From WES TR H-76-1, Grid PT 10 (Cleveland)
10 year, Angle Class 2, Winter wave $H_o = 12.1'$
$T_o = 8.4$ sec

DESIGN LAKE LEVEL

From NCE (1979) Standardized Frequency Curves for Design Water Level Determination on the Great Lakes
20 year Annual mean for L. Erie = 573.1

From L Erie & Ontario Waterway Report (1973) NCB
1 year short period fluctuation at Cleveland = 1.45'

∴ 20 year Lake Level = 573.1 + 1.45 = 574.55 (+5.95) Say +6.0

DESIGN WATER DEPTH

No soundings available - conservative assumptions were made!

Based on USGS Topographic maps the offshore slopes range from .04 to .009 for the Brathahl area and .02 to .01 for Perkins Beach. Therefore using a slope of .03 the elevation 50 feet offshore off the bluff face = -1.5 LWD

$d_s = 6.0 (LL) + 1.5 (sounding) = 7.5'$ of water

INCIDENT WAVE

REFRACTION COEFFICIENT (From CERC TP 80-3, Fig A-1)

$\alpha' = 0°$ for Perkins Beach } Least refractive wave for both sites is the Angle Class 2 wave which can come in normal to shore
$\alpha' = 0°$ for Brathahl }

$S = 4$ (Wind waves)

$$\frac{(d_s)}{(gT^2)} = \frac{7.5}{(32.2)(8.4)^2} = .0033$$

K_R Perkins Beach = 1.0
K_R Brathahl = 1.0

$H_o' = 12.1 \times 1.0 = 12.1$ (Perkins)

$H_o' = 12.1 \times 1.0 = 12.1$ (Brathahl)

BY Pope DATE 30 JUNE SUBJECT Cleveland Hbr - Sect III SHEET NO 2 OF 4
CHKD BY DATE Revetment Design
Alternative IV A+B

INCIDENT WAVE

GODA CORRECTION TO DETERMINE H_{max} (Irregular wave Theory)

$L_o = 5.12 (8.4)^2 = 361'$ slope = 1/35

$H_o' = 12.1$

$H_b/L_o = 12.1/361 = 0.034$ $d_s/H_o' = 7.5/12.1 = 0.62$

From TP 80.3

Fig	H_b/L_o	m	H_{max}/H_o'	H_{sig}/H_o'
B-14	.04	1/20	.7	.57
B-15	.02	1/20	.65	.52
B-8	.04	1/50	.6	.47
B-9	.02	1/50	.56	.45

INTERPOLATED for $H_o'/L_o = 0.03$ slope, m = 1/35

for $H_{max}/H_o' = 0.63$ for $H_{sig}/H_o' = 0.50$

$H_{max} = 7.6'$ $H_{sig} = 6.1'$

Regular wave theory (Fig 7-4) suggests the breaking wave limit of: $d_s/gT^2 = .0033$, m = 0.03

$H_b/d_s = 1.05$ $\therefore$ $H_b = (7.5)(1.05) = 7.9'$

Therefore, the H_{sig} of 6.1' can exist as a non breaking wave and is the design wave

STONE ANALYSIS

$$W = \frac{W_r (H_{sig})^3}{K_D (S_r - 1)^3 \cot\theta}$$

$$W = \frac{(155)(6.1)^3}{(4.0)(2.48-1)^3(2)} = 1357\#$$

W_r = weight of armor unit in lbs = 155 pcf
H_{sig} = 6.1
K_D = stability coefficient = 4.0
S_r = specific gravity of armorstone = 155/62.4 = 2.48
$\cot\theta$ = 2.0

ARMOR STONE GRADATION
$2W \rightarrow .9W = 2714 \rightarrow 1221$ [say 3/4 to 1½ Tons]

ARMOR LAYER THICKNESS
$r = n.K_D \left(\frac{W}{W_r}\right)^{1/3} = 2(1.15)\left(\frac{1357}{155}\right)^{1/3} = 4.7'$ SAY 5.0'

For Crest width, $n_1 = 3$, $\therefore$ Crest width = 7.5'

Under Layer STONE Gradation
$.2W \rightarrow .06W = 271 \rightarrow 811$ lbs [say 100 to 300 lbs]

THICKNESS $r = (2)(1.15)\left(\frac{1357}{155}\right)^{1/3} = 2.2'$

Bedding STONE
$0.01W \rightarrow .0015W = 14\#' \rightarrow 0.2\#$ [say Fine to 15#]

BY Pope DATE 30 Jun 82 SUBJECT Cleveland Hbr Section 111 SHEET NO 3 OF 4
CHKD BY DATE Revetment Design JOB NO

RUN-UP ANALYSIS

Using CETA 79-6 equation [4] and [5]

$$\frac{R}{H_I} = \frac{a\xi}{1+b\xi}$$

Where $H_I = H_{s,g} = 6.1$ $L_o = 361'$

R = wave run up

$a = 0.692$ for rubble mound

$b = 0.504$ for rubble mound

$$\xi = \frac{\tan\theta}{\sqrt{H_I/L_o}}$$ where $\tan\theta$ = angle of structure slope = 0.5

$$\xi = \frac{0.5}{\sqrt{6.1/361}} = 3.846$$

$$\frac{R}{H_I} = \frac{R}{6.1} = \frac{0.692(3.846)}{1+(0.504)(3.846)} = .906$$

$$R = (.906)(6.1) = 5.5' \text{ run up}$$

REVETMENT CREST HEIGHT

Assume "0" overtopping

Crest height = run up + design water level
= 5.5' + 6.0' = 11.5' above LWD

PRINTS

BY Pope DATE 30 Jan 82 SUBJECT Cleveland Hbr Sect 111 Revetment Design Alt IV A and B SHEET NO 4 OF 4

CHKD. BY DATE JOB NO

SKETCH OF GENERALIZED REVETMENT CROSS SECTION (ALTERNATIVE IV A and B)

SIZES

ARMOR = 3/4 to 1½ Ton
UNDERLAYER = 100 to 300 lbs
BEDDING = Fines to 15 lbs
TOE STONE = 1½ Ton

CLEVELAND HARBOR, OH
SECTION III

APPENDIX C
ECONOMICS

April 1983

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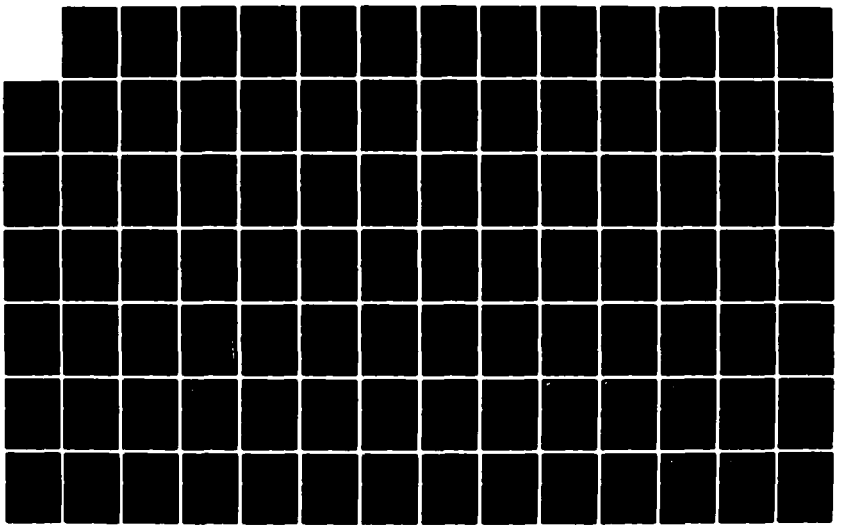
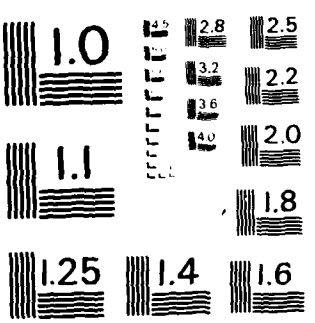




CLEVELAND HARBOR
SECTION III

APPENDIX C

C1. EVALUATION

C1.1 Introduction.

A regional shoreline evaluation was conducted which included the Cuyahoga County shoreline from Rocky River east through Cleveland to the Cuyahoga-Lake County Line and included the communities of Lakewood, Cleveland, Bratenahl, East Cleveland, and Euclid. This includes over 21 miles of shore, of which almost 7 miles are within the Cleveland Harbor/Edgewater Park area and thus are protected by the harbor structures from aggrevated shore erosion. Of the remaining shore which was evaluated, 9 miles are east of the harbor and 5 miles are west of the harbor.

The shoreline was divided into 14 Study Reaches for purposes of analysis. Each Reach is defined by a recognizable geographic boundary, a general uniformity of recession, geology and shore protection. Each Reach is identified in Appendix A, Table A1.

As a result of the Coastal Engineering recession rate analysis of the above mentioned 14 Study Reaches, only Reach 8 and part of Reach 10 were identified as study areas to be further evaluated to determine the potential impacts of the Federal Harbor on shore erosion.

Reach 8 and a portion of Reach 10 were selected for evaluation based on the significant shore recession rates (more than 1-foot/year) which cannot be readily explained, and the potential impact of the Federal Harbor on shore erosion in these areas.

C2. IMPACTS TO THE BRATENAHL SHORE

C2.1 Introduction.

The Bratenahl shore is 2.4 miles long or 12,672 feet. Coastal Engineering evaluation of shore recession (Appendix A) has determined that the total existing erosion rate for the 3,500-foot eastern end of the Bratenahl shore (2.8 feet/year) represents 1.7 feet/year of White City induced erosion, 1-foot/year of natural recession, and 0.1-foot/year of Cleveland Harbor induced erosion minus the effects of private shore protection. The shore recession rate for the rest of the Bratenahl shore breaks down as 1.1-foot/year total existing erosion rate, of which 1.0 feet/year is natural recession and 0.1-foot/year is induced by Cleveland Harbor minus the private shore protection efforts.

C2.2 The existing data does not allow sorting out the protective efforts of private structures from the additional recession effects of the Cleveland Harbor project.

C2.3 For purposes of economic evaluation the Bratenahl shore was subdivided into a 3,500-foot eastern portion and a 9,172 feet western portion, each area is characterized by shore erosion rate as previously described.

C2.3.1 Residential and Public Land Loss.

a. Eastern Portion of the Bratenahl Shore.

Existing long term erosion trends indicate that 9,800 square feet/year of residential land is currently subject to erosion in the 3,500-foot eastern portion of the Bratenahl shore, (2.8 feet/year, erosion rate X 3,500 feet shoreline = 9,800 feet/year). The area (lot dimensions) of each affected parcel was obtained from the Cuyahoga County Assessor's Office. Land affected by erosion in this area has a current appraised value of $24,000 per acre which equates to $.55 per square foot. Based on the above information total annual residential land loss damages are calculated as $5,390 per year. Of this amount, $190 average annual land loss damage is considered to be induced by the Federal Harbor project.

b. Western Portion of the Bratenahl Shore.

Existing long-term erosion trends indicate that 10,090 square feet/year of principally residential land is currently subject to erosion in the 9,172 feet western portion of the Bratenahl shore, (1.1-foot/year erosion rate X 9,172 feet shoreline = 10,090 feet/year). Using the same methodology for determining average annual land loss as was employed in evaluation of the eastern end of the Bratenahl shore and a value of $.51/square-foot ($22,000/acre) as derived from current real estate appraisal results in $5,150 annual land loss. Of this amount, $470 average annual land loss damage is considered to be induced by the Federal Harbor project.

C2.3.2 Residential Structure Damage.

Five structures on the eastern portion of the Bratenahl shore are identified as being damaged by erosion in the 50-year project evaluation period. Assessed values of these structures were adjusted by the ratio of recent area sales to assessed valuations. Average annual damages are calculated using the assumption that rational property owners will choose to move their structures further inland on existing lots rather than lose their structures to the lake, if the cost of relocation is less than the value of the structure. Total without project average annual structure damages for the five structures are $3,000. This calculation is presented in Table C1.

No structures on the western portion of the Bratenahl on the western portion of the Bratenahl shore are identified as being damaged by erosion in the 50-year project evaluation period.

Table C1 - Structure Damage

Number	Market Value	Cost of Relocating Structure (1)	Year That Bluff Recedes to Within 10 Feet of Structure: Year	Project Year	Present Worth Factor (7-5/8 Percent)	Present Worth (1990)
	$	$				$
1	59,330	35,000	2015	25	.15928	5,570
2	40,260	35,000	2006	16	.30860	10,800
3	54,870	35,000	2015	25	.15928	5,570
4	46,030	35,000	2015	25	.15928	5,570
5	40,390	35,000	2006	16	.30860	10,800

Total Present Worth $38,310
Capital Recovery Factor .07823,
Average Annual Structure Damage = $3,000

(1) Real estate estimate of the cost of relocating structure further inland on the existing lot.

Total without project average annual damages, $13,540, for the Bratenahl area are summarized in Table C2.

Table C2 - Without Project Average Annual Damages Bratenahl Area

	Total Damage
	$
Land Loss Damage	10,540
Structural Damage	3,000
Total Damage	$13,540

C3. IMPACTS TO THE PERKINS BEACH SHORE

C3.1 Introduction.

The Perkins Beach shore is 0.4 miles long on 2,112 feet. Coastal Engineering evaluation of shore recession (Appendix A) has determined that the total existing erosion rate for this reach is 1.3 feet/year, of which 0.8 feet/year is natural recession and 0.5 feet/year of Cleveland Harbor induced erosion minus the efforts of private shore protection.

Again, the existing data does not allow sorting out the protective efforts of private structures from the additional recession effects fo the Cleveland Harbor project.

For purposes of economic evaluation of the Perkins Beach shore was subdivided into a 1,231-foot eastern portin and a 881-foot western portion. Each area is characterized by distinct development conditions.

C3.2 Residential and Public Land Loss.

a. Eastern Portion of the Perkins Beach Shore.

Existing long-term erosion trends indicate that 1,600 square-foot/year of public land is currently subject to erosion in the 1,231-foot eastern portion of the Perkins Beach shore, (1.3 feet/year X 1,231-foot shoreline = 1,600-foot/year). For purposes of this analysis the square feet value of this public land is assumed equal to the value per square feet of affected land in the western portion of Perkins Beach, $.57 per square foot ($25,000/acre). In future study the replacement value as well as the recreation use value of this public land will be considered for use in the evaluation. Based on the above information, annual land loss damages are $910 per year. Of this amount, $350 average annual land loss damage is considered to be induced by the Federal Harbor project.

b. Western Portion of the Perkins Beach Shore.

Existing long-term erosion trends indicate that 1,145 square feet/year of residential land is cuarrently subject to erosion in the 881 feet western portion of the Perkins Beach shore, (1.3 feet/year erosion rate X 881-foot shoreline = 1,145 feet/year). The area (lot dimensions) of each affected parcel was obtained from the Cuyahoga County Assessor's office. Land affected by erosion in this area has a current appraised value of $25,000/acre which equates to $.57 per square foot. Based on the above information, annual residential land loss damages are calculated as $650 per year.

Of this amount, $250 average annual land loss damage is considered to be induced by the Federal Harbor project.

C3.3 Residential Structure Damage.

a. Eastern Portion of the Perkins Beach Shore.

Access to 11 properties on the eastern portion of the Perkins Beach shore have been identified as being affected by erosion in the 50 year evaluation period. It has been determined that access will be affected in project year 31 at which time the existing access road (cliff drive) will be compromised by erosion. It is assumed that the value of these properities will decline in project year 31 by an amount equal to the cost of providing road access to each property. Real Estate Branch has estimated this cost at $15,200 per property or $167,200 total cost. This cost brought to present value and amortized over the 50-year project evaluation period amounts to

$1,340 and represents average annual structural damage/loss in this area. Of this amount, none of the structural damage/loss can be attributed to the Federal Harbor project.

b. Western Portion of the Perkins Beach Shore.

No structures on the western portion of the Perkins Beach shore are identified as being affected by erosion in the 50-year project evaluation period.

Total without project average annual damages, $2,900, for the Perkins Beach area are summarized in Table C3.

Table C3 - Without Project Average Annual Damages Perkins Beach Area

	Total Damage
Land Loss Damage	$1,560
Structural Damage	1,340
Total Damage	$2,900

C4. EVALUATION OF PLANS OF IMPROVEMENT

Plan IA - Do Nothing - Bratenahl. There is no damage reduction benefit, or other cost savings associated with this alternative.

Plan IB - Do Nothing - Perkins Beach. There is no change reduction benefit, or other cost savings associated with this alternative.

Plan IIA - Offshore Disposal Dredged Sand - Bratenahl. Annual offshore disposal of dredged sand at Bratenahl instead of disposal at Dike 14 will result in annual cost savings of $220,720 (reference NCBED-DG DF of 7 Sep 82, Cleveland Harbor Section III Cost Estimate). This plan requires 35,600 cubic yards of total material to be deposited annually offshore. The cost of depositing material at Dike 14 is $6.20/cubic yard . Therefore, $220,720 (35,600 cubic yards X $6.20/cubic yard = $220,720) annual cost savings benefit is associated with Plan IIA. Implementation of this plan will also result in elimination of the Federal induced erosion. Calculation of without and with project damages and benefits of this alternative are presented in Table C4. Benefit/cost comparisons are presented in Table C5.

Plan IIB - Offshore Disposal of Dredged Sand - Perkins Beach. Annual offshore disposal of sand at Perkins Beach instead of Disposal at Dike 14 will result in annual cost savings of $73,780 (reference NCBED-DG DF of 7 Sep 82, Cleveland Harbor Section III Cost Estimate). This plan requires 11,900 cubic yards of total material to be deposited annually offshore. The cost of depositing material at Dike 14 is $6.20/cubic yard. Therefore, $73,780 (11,900 cubic yards X $6.20/cubic yard = $73,780) annual cost savings benefit is associated with Plan IIB. Implementation of this plan

will also result in elimination of the Federal induced erosion. Calculation of without and with project damages and benefits of this alternative are presented in Table C4. Benefit/Cost comparisons are presented in Table C5.

Plan IIIA - Feeder Beach - Bratenahl. This plan will result in elimination of average annual Federal induced erosion amounting to $860. Calculation of without and with project damages, and benefits of this alternative are presented in Table C4. Benefit/cost comparisons are presented in Table C5.

Plan IIIB - Feeder Beach - Perkins Beach. This plan will result in elimination of average annual Federal induced erosion amounting to $1,940. Calculation of without and with project damages, and benefits of this alternative are presented in Table C4. Benefit/cost comparisons are presented in Table C5.

Plan IVA - Shore Revetment - Bratenahl. This plan will result in elimination of total average annual erosion damages amounting to $13,540. Calculation of without project damages, and benefits of this alternative are presented in Table C4. Benefit/cost comparisions are presented in Table C5.

Plan IVB - Shore Revetment - Perkins Beach. This plan will result in elimination of total average annual erosion damage amounting to $2,900. Calculation of without project damages, and benefits of this alternative are presented in Table C4. Benefit/cost comparisons are presented in Table C5.

As is clearly evident from Table C5 Plans IIA and IIB are the only economically feasible plans (B/C ratios greater than 1.0). These plans provide maximum net benefit to the respective areas, Bratenahl and Perkins Beach, and thus are considered the NED recommended plans.

It should be noted that the estimate of required quantities of material deposited offshore (Alternatives IIA and IIB) is a very sensitive portion of the analysis. The final report will present a sensitivity analysis for this alternative. Further, the final report will incorporate interest during construction into the analysis as the construction schedule will be specified for the final report.

Table C4 - Without Project Average Annual Damages, and Benefits Associated With Alternative Plans

Alternative Plan	Without Project Damage	With Project Damage	Benefit
	$	$	$
IA			
Land Loss	10,540	10,540	0
Structure Damage	3,000	3,000	0
Total	13,540	13,540	0
IB			
Land Loss	1,560	1,560	0
Structure Damage	1,340	1,340	0
Total	2,990	2,990	0
IIA			
Land Loss	10,540	9,880	660
Structure Damage	3,000	2,800	200
Dredge Disposal Cost Saving	-	-	220,720
Total	13,540	12,680	221,580
IIB			
Land Loss	1,560	960	600
Structure Damage	1,340	0	1,340
Dredge Disposal Cost Savings	-	-	73,780
Total	2,900	960	75,720
IIIA			
Land Loss	10,540	9,880	660
Structure Damage	3,000	2,800	200
Total	13,540	12,680	860
IIIB			
Land Loss	1,560	960	600
Structure Damage	1,340	0	1,340
Total	2,900	960	1,940
IVA			
Land Loss	10,540	0	10,540
Structure Damage	3,000	0	3,000
Total	13,540	0	13,540
IVB			
Land Loss	1,560	0	1,560
Structure Damage	1,340	0	1,340
Total	2,900	0	2,900

Table C5 - Benefit Cost Comparisons for Alternative Improvements

Alternative	Annual Benefit	Average Annual Cost	B/C Ratio	Net Benefit
	$	$		$
IA	-	-	-	-
IB	-	-	-	-
IIA	221,580	160,200	1.38	+ 61,380
IIB	75,720	44,030	1.72	+31,690
IIIA	860	170,000	.01	-169,140
IIIB	1,940	56,000	.04	-54,060
IVA	13,540	710,330	.02	-696,790
IVB	2,900	89,960	.03	-87,060

CLEVELAND HARBOR, OH
SECTION III

APPENDIX D
ENVIRONMENTAL CONSIDERATIONS

April 1983

CLEVELAND HARBOR
SECTION 111

APPENDIX D

TABLE OF CONTENTS

REFERENCE MATERIAL

REFERENCE MATERIAL (Cont'd)

CLEVELAND HARBOR
SECTION 111

APPENDIX D

D1. NATURAL ENVIRONMENT

a. Existing Conditions. The Buffalo District has assembled preliminary environmental baseline data for the Cleveland, OH, area. Analysis of shoreline recession rates by the Buffalo District indicates that, of the total study area, only Reach 8 (the Bratenahl shoreline) and part of Reach 10 (the Perkins Beach groin field and 800 feet to the west, hereafter referred to as "Perkins Beach") should be further evaluated to determine the potential impacts of the Federal harbor on shore erosion. Where possible, environmental data collection efforts have been focused on Reaches 8 and 10. The geographic limits for the Cleveland Section 111 study, Reach 8 and Reach 10, are identified on Figures 1, 2, and 3, respectively.

The data gathered thus far, plus additional information to be gained through more detailed planning, will provide a data base for impact assessment and evaluation purposes. Preliminary information was obtained primarily through a review of the existing literature, field studies, and coordination with the appropriate resource agencies.

Descriptions of the shoreline within the Cleveland Section 111 study limits are contained in Appendix A of the Main Report and in the 28 March 1977 Preliminary Report on Section 111 Study of Cleveland Harbor, OH. Existing Buffalo District reports and Environmental Impact Statements for harbor modification, diked disposal site construction, and Corps Operation and Maintenance activities contain significant quantities of environmental data for the Cleveland, OH, area. Relevant information will continue to be updated with more recent data, as it is available.

Field investigations of the study area were conducted by Buffalo District staff on 24-26 March 1982. These investigations included inspections of various points along the study shoreline, discussions with Cuyahoga County and Bratenahl Village officials regarding shoreline erosion, and sediment sampling in the upstream reaches of the Federal navigation channel in the Cuyahoga River. Sediment sampling techniques and field notes are included in Attachments 1 and 2.

Sediment grain size analyses of the Cuyahoga River sediment samples were performed by the Ohio River Division Laboratory of the U. S. Army Corps of Engineers, Cincinnati, OH (Attachment 3). Bulk chemical analyses and elutriate tests were performed by EG&G, Bionomics, Wareham, Massachusetts (Attachment 4). Testing indicated that the sediments at the upstream end of the Federal Navigation Channel (river survey stations Nos. 819, 815, and 812) consisted predominantly of clean, fine-grained sand.

b. Concerns Associated with Project Alternatives. Proposed structural, nonstructural, and "no action" alternatives for Reaches 8 and 10 are identified in Attachment 5. Although four additional alternatives were considered

briefly (Groins at Bratenahl, Groins at Perkins Beach, Offshore Breakwaters at Bratenahl, and Offshore Breakwaters at Perkins Beach), these alternatives were eliminated based on the District's experiences with similar structures as discussed in the Main Report.

A summary matrix of potential impacts associated with each of the proposed project alternatives is presented as Table A. The matrix is an indication of the general magnitude of potential beneficial and adverse impacts associated with the environmental parameters listed. Although more refined environmental analyses would be performed during Stage 3 planning efforts, specific environmental concerns were identified during Stage 2 planning and are discussed below.

Implementation of "No Action" at Bratenahl (Alternative IA) and/or Perkins Beach (Alternative IB) would allow erosion to continue along the affected shoreline(s) at its present rate as described in Appendix A of the Main Report. Any beneficial impacts associated with the mitigation of Federally caused erosion under the proposed action alternatives would be foregone at the "no action" site(s). The "No Action" Alternative at either site would allow erosion to continue, which is not desirable from an environmental standpoint. The "No Action" Alternatives would also not meet the planning objective to mitigate erosion attributable to the Cleveland Federal Project.

All of the action alternatives currently under consideration by the Buffalo District (Alternatives IIA, IIB, IIIA, IIIB, IVA, and IVB) would provide positive environmental benefits by mitigating Federally induced erosion. No freshwater wetlands or endangered species have been identified as occurring along the shoreline of either Bratenahl or Perkins Beach. Although currently available information indicates that no impacts to endangered species would occur under any of the proposed alternatives, formal coordination as required under Section 7 of the Endangered Species Act will be performed during Stage 3 planning.

The use of dredged material for nourishment of the littoral drift system under Alternatives IIA and IIB would result in the conservation of sand which would otherwise have been discarded in a diked disposal area. The offshore disposal of sand would also be expected to conserve fuel, since less time should be required for the operation of the disposal equipment.

Alternatives IIA and IIB would be expected to produce temporary, adverse impacts to water quality, benthic macroinvertebrates, plankton, and fishery resources at the disposal site(s). Temporary, minor air quality impacts would be expected due to emmissions produced by the disposal equipment. Based on the sediment test results cited above, negligible long-term impacts to water quality and plankton are expected. Although benthic macroinvertebrates would be covered and destroyed during disposal, rapid recolonization of the disposal site(s) would be expected to occur. Since the sediment quality at the disposal sites is presently unknown, it is also not known whether benthic macroinvertebrate species composition might be altered due to disposal. The value of the potential disposal sites as benthic habitat and as fish spawning/nursery areas is presently unknown and will be more thoroughly evaluated as appropriate during Stage 3 planning efforts.

Alternatives IIIA and IIIB would produce temporary impacts to water and air quality due to the placement of fill and the operation of heavy machinery during each annual beach nourishment operation. No significant impacts to sediment quality would be expected. The feeder beachfill operations would require the yearly commitment of sand and fuel required for sand placement. During sand placement operations along the Lake Erie shoreline, minor impacts may occur to benthic macroinvertebrates, plankton, and fishery resources at the work site(s). However, since the potential feeder beach sites are high energy environments which are constantly disturbed by wave action, no significant long-term impacts to benthos, plankton, or fish are expected to occur. Limited quantities of terrestrial vegetation may be destroyed and some minor displacement of small mammals and/or birds may occur during feeder beachfill operations.

Alternatives IVA and IVB would produce temporary impacts to water and air quality due to the operation of heavy machinery during construction. No significant adverse impacts to sediment quality should occur. Construction of the revetment(s) and periodic maintenance would require the commitment of structural stone and fuel required for machinery operation. Some temporary impacts to benthic macroinvertebrates, plankton, and fish may occur during construction. Positive long-term benefits to benthos and fish may be provided by the rubble revetment, depending on the design configuration of the revetment and the amount of aquatic habitat modified. The destruction of some terrestrial vegetation and the displacement of some small mammals and/or birds may occur during construction.

Preliminary mitigation/enhancement considerations for Alternatives IIA, IIB, IIIA, IIIB, IVA, and IVB are discussed in Attachment 6.

c. Agency Coordination. The Buffalo District initiated formal coordination with the U. S. Fish and Wildlife Service (USFWS) in a letter dated 3 March 1982. The Buffalo District requested that the USFWS provide input for Stage 2 planning efforts in the form of a planning aid letter to be received by the Buffalo District no later than 1 September 1982. The agreement between the Buffalo District and the Columbus Field Office of the USFWS for field level funding during Fiscal Year 1982 was amended accordingly.

Written descriptions of Alternatives 1A, IB,IIA, IIB, IIIB, and IVB were provided to the USFWS, the U. S. Environmental Protection Agency (USEPA), and the Ohio Department of Natural Resources (ODNR) in letters dated 15 July 1982. Descriptions of Alternatives IIIA and IVA were provided over the phone to the USEPA and ODNR on 11 August 1982 and to the USFWS on 12 August 1982. Written descriptions of Alternatives IIIA and IVA were provided to the above agencies in letters dated 23 August 1982. Comments submitted by the USFWS, the USEPA, and the ODNR are presented as Attachments 7, 8, and 9, respectively.

The planning aid letter provided by the USFWS contained a general discussion of fish and wildlife resources in the study area and included a discussion of

environmental impacts associated with the project alternatives. The USFWS stated that all construction alternatives proposed for Bratenahl and Perkins Beach probably would not cause significant adverse impacts on the aquatic resources of the area. They felt that Alternatives IVA and IVB may provide a net benefit for the aquatic resources of the Cleveland area. If Alternatives IVA and/or IVB are to be selected, the USFWS recommended that modifying the revetments for use as shoreline fishing areas be investigated.

The USFWS stated that if Alternatives IIA and IIB are selected as the preferred alternatives, future planning should define the disposal area and the site specific habitat of that area. With the selection of a preferred disposal site, they recommended that aquatic surveys be conducted to identify any site specific spawning, nursery, or feeding areas that may be impacted by placement of fill material. The USFWS recommended that since the upper Cuyahoga River sediment testing was a "one shot" analysis, additional tests should be conducted on the material in the spring of 1983 or before the material is dredged and placed in the littoral system.

The USEPA stated that based on physical and chemical analyses, the sediments from the three upper Cuyahoga River sample sites (Stations 819, 815, and 812) appeared to be predominantly clean, fine-grained sands. They recommended further consideration of Alternatives IIA and IIB. The USEPA had no specific comments on the other proposed alternatives and did not anticipate that they would result in significant, adverse environmental impacts. They felt that the Buffalo District should investigate the use of sediments from the upper Cuyahoga River channel in the construction of a feeder beachfill (pumping the clean sand from the dredge site or a hopper dredge onto the shoreline).

The ODNR had no specific objection to any of the proposed alternatives and did not expect that any of the alternatives provided would result in significant environmental impacts. Specific comments regarding several of the project alternatives were provided.

D2. HUMAN ENVIRONMENT

a. Existing Conditions. The Buffalo District has assembled preliminary information regarding the human environment through a review of the existing literature, general field observations, and through coordination with appropriate regional and local agencies. Information related to the human environment was collected through the efforts of both the Environmental Resources Branch and the Economics Branch of the Buffalo District.

Considerable information for the general Cleveland, OH, area was obtained from past Buffalo District reports and from the Draft Report for the Coastal Zone Management (CZM) Program in Cuyahoga County, OH, which was prepared by the Regional Planning Commission in 1977. The Draft CZM Report contains information regarding existing and future land use along the Cuyahoga County shoreline. Data related to zoning, social, and economic parameters is also included in the Draft CZM Report.

More recent human environmental data for the Cleveland area is contained in the Cleveland Harbor, OH, Stage 2 Report for Reformulation Phase I General

Design Memorandum completed by the Buffalo District in July 1982. Additional, more site specific information for Reaches 8 and 10 was provided by both the Cuyahoga County Regional Planning Commission and the Cleveland City Planning Commission. Profile census data reports have been obtained for Cleveland and Cuyahoga County census tracts 1011 and 1928. The profile reports were prepared by the Northern Ohio Data and Information Service of Cleveland State University using 1980 census data.

The information cited above will continue to be updated, as appropriate, and utilized during Stage 3 planning efforts.

b. Concerns Associated with Project Alternatives. The potential magnitudes of beneficial and adverse impacts on the human environment are summarized on Table D1. Although further analyses would be performed during Stage 3 planning, specific environmental concerns identified during Stage 2 are summarized below. Potential mitigation/enhancement measures are discussed in Attachment 6.

Under the "No Action" Alternatives for Bratenahl and Perkins Beach, erosion would continue at its present rate. Over the long term, continued erosion could cause damages to public and private property, man-made resources, and recreational opportunities along both the Bratenahl and Perkins Beach shorelines. Since a portion of the Perkins Beach shoreline and most of the Bratenahl shoreline consist of residential areas, continued erosion may result in the displacement of people presently residing along the lake shore. Public facilities and services might be affected at both sites, since a portion of Perkins Beach consists of a public park and a portion of the Bratenahl shoreline is occupied by a U. S. military reservation. However, the shoreline along the U. S. military reservation is presently protected with heavy stone. At both Bratenahl and Perkins Beach, continued erosion would result in adverse aesthetic impacts and could potentially affect community cohesion and tax revenues over the long term.

No farms exist at either Bratenahl or Perkins Beach. No known businesses occur at Perkins Beach. The only known business establishments at Bratenahl which could potentially be impacted are a country club and an apartment complex which are located along the lake shore. Continued erosion resulting from "no action" could potentially impact recreation, public facilities, and services at Perkins Beach. Recreation activities could potentially be affected at the Lakeshore Country Club at Bratenahl due to continued erosion. Continued erosion may have some minor impact on community growth at both Bratenahl and Perkins Beach. No significant impacts on noise or employment would be expected at either site.

All of the proposed action alternatives would be expected to provide positive environmental benefits by mitigating the negative impacts on the human environment that would occur under the base case ("no action"). Implementation of any of the proposed action alternatives would constitute a business activity which would provide short-term benefits to business, employment, and income tax revenues.

Alternative IIA would be expected to produce adverse impacts on the human environment. Although an increase in water turbidity may have some minor impacts on sport fishing under both alternatives and possibly on swimming under Alternative IIB, these impacts would be of short duration and would cease shortly after the disposal operation was complete. Recreational impacts could potentially be minimized by scheduling activities so that disposal would occur during times of low fishing and swimming activity. Although some noise would be generated by the disposal equipment, the operations under both Alternatives IIA and IIB would be performed in an area well removed from human activities, causing no significant impacts.

Under Alternatives IIIA, IIIB, IVA, and IVB, temporary impacts to noise, aesthetics, and possibly recreation may occur at the construction site(s). Under Alternative IVB, public access to the park land at Perkins Beach may be restricted during construction. Man-made resources, primarily in the form of shore protection, would be modified under Alternatives IVA and IVB.

c. Agency Coordination. Letters dated 7 June 1982 were sent to local officials and planning agencies requesting current information regarding the human environment. Specific requests were made for information on Reaches 8 and 10, when data was available. Local entities contacted included the Cleveland City Planning Commission, the city of Cleveland's Director of Community Development, the President of the Cuyahoga County Commissioners, the Executive Director of the Cleveland-Cuyahoga Port Authority, and the Cleveland Metroparks System.

Relevant information for Reaches 8 and 10 was provided by the Cleveland City Planning Commission and the Cuyahoga County Regional Planning Commission. The Cleveland Metroparks System declined to provide any information as the Metroparks had no controlling interest in Reaches 8 and 10. No response was received from the Director of Community Development, the President of the Cuyahoga County Commissioners, or the Cleveland-Cuyahoga County Port Authority.

Copies of letters provided by the Cleveland City Planning Commissiion and the Regional Planning Commission are provided as Attachments 10 and 11, respectively. Additional supporting information provided by these agencies is contained in the Environmental Resources Branch file for the study.

Agency and public coordination will be conducted as appropriate during Stage 3 planning to fulfill the requirements of the National Environmental Policy Act (NEPA), and Section 404 of the Clean Water Act, and other applicable environmental statutes. In order to assure compliance with NEPA, the Buffalo District proposes to prepare Draft and Final Environmental Impact Statements (EIS's) or an Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) which will be included within the Draft and Final Detailed Project Reports (DPR's), respectively.

D3. CULTURAL RESOURCES

The latest published version of the National Register of Historic Places has been consulted. No registered properties or properties listed as being eligible for inclusion were identified in either Reach 8 or Reach 10.

Letters dated 14 June 1982 and 23 July 1982 were sent to the State Historic Preservation Officer (SHPO) and the National Park Service (NPS) regarding the Cleveland Section 111 study. Comments submitted to the Buffalo District by the SHPO and the NPS are included as Attachments 12 and 13.

The SHPO stated that a number of residences along Lake Shore Boulevard at Bratenahl have been surveyed for the Ohio Historic Inventory and appear to be eligible for the National Register. The Howard M. Hanna, Jr., residence was found to be in close proximity to the shoreline in the Bratenahl (Reach 8) area. The SHPO stated that there do not appear to be any recorded cultural resources in the Reach 10 area. The NPS was not aware of any significant cultural resources which would be affected by any of the proposed project alternatives.

Further coordination regarding cultural resources will be conducted as appropriate during Stage 3 planning efforts.

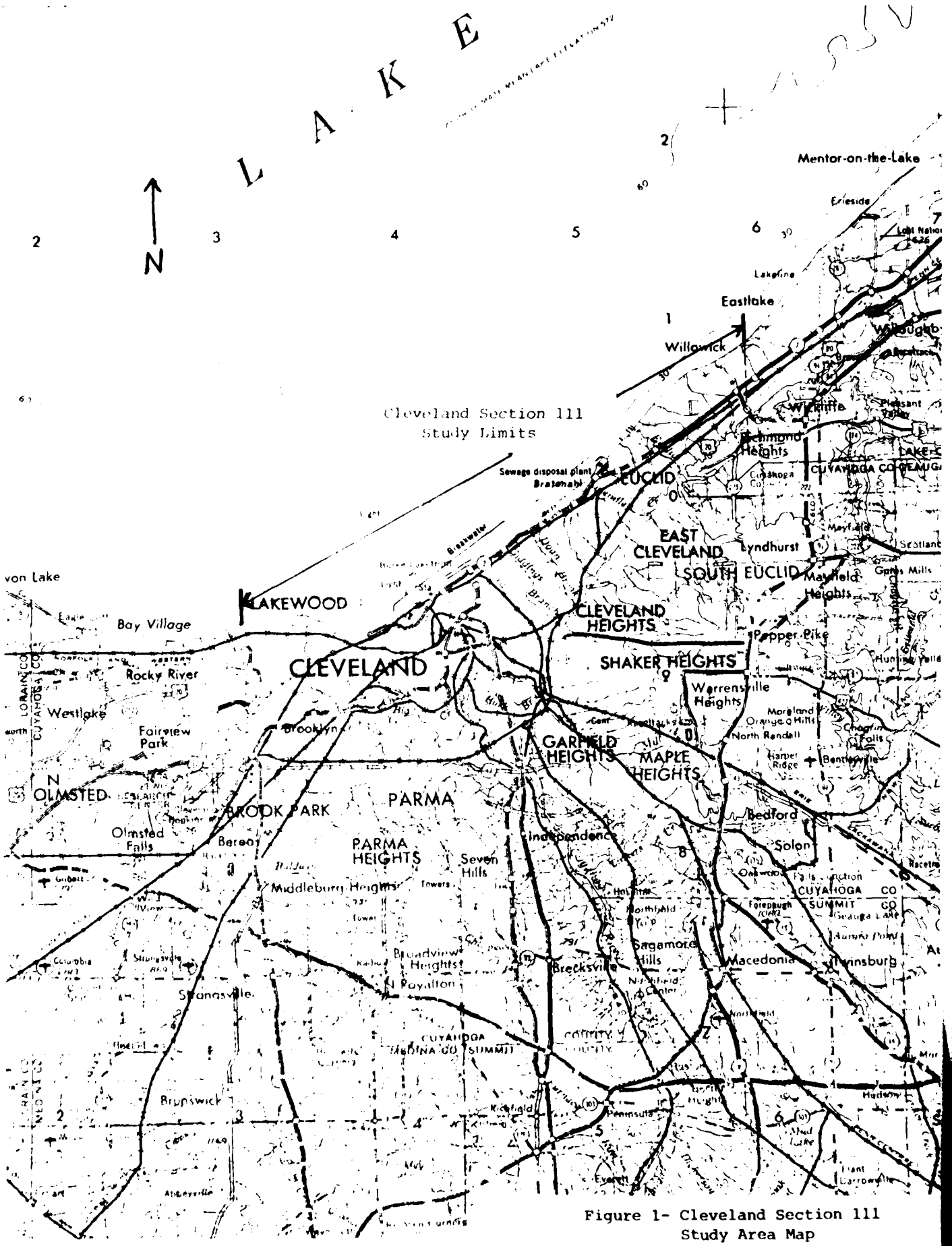
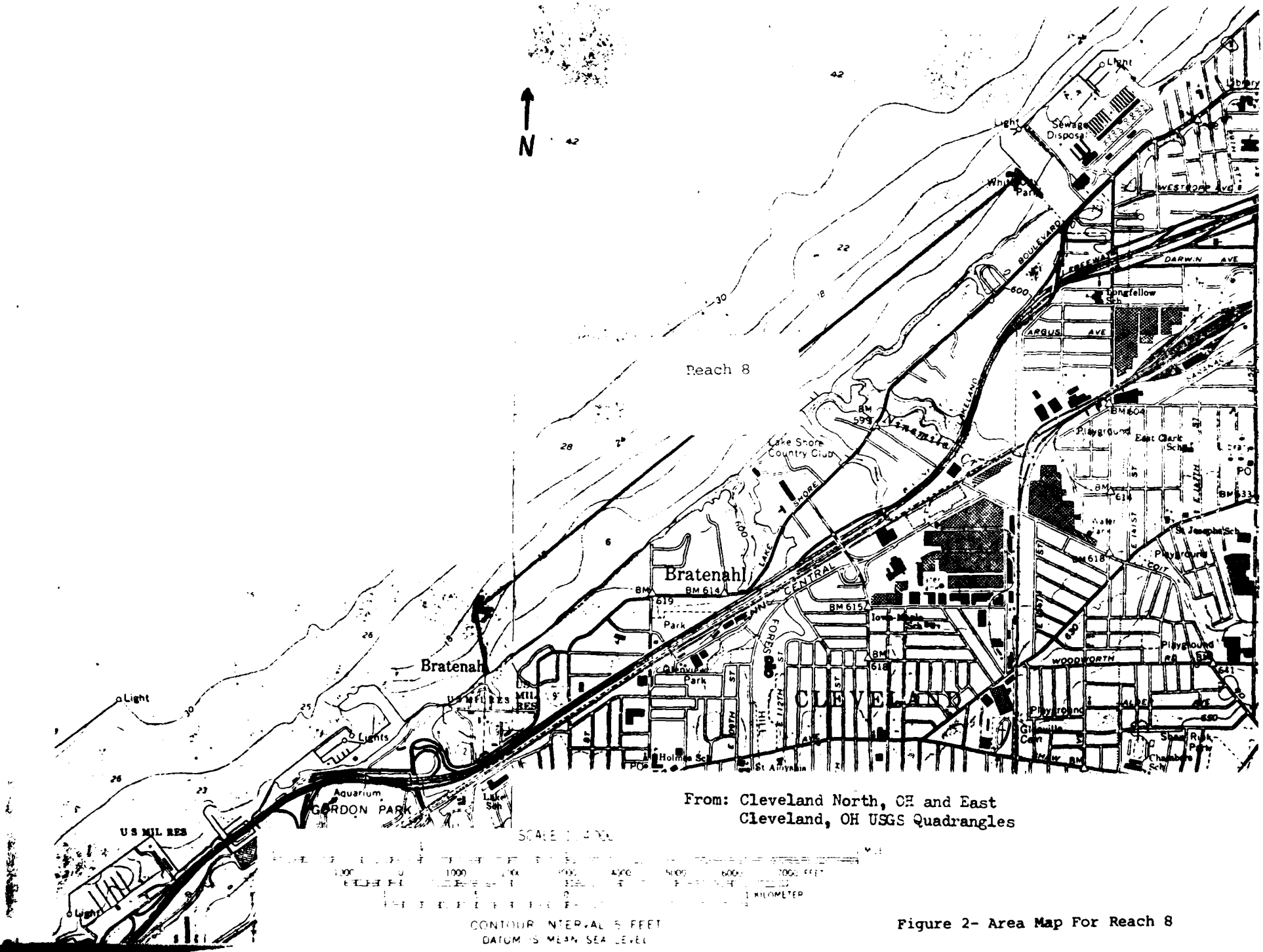
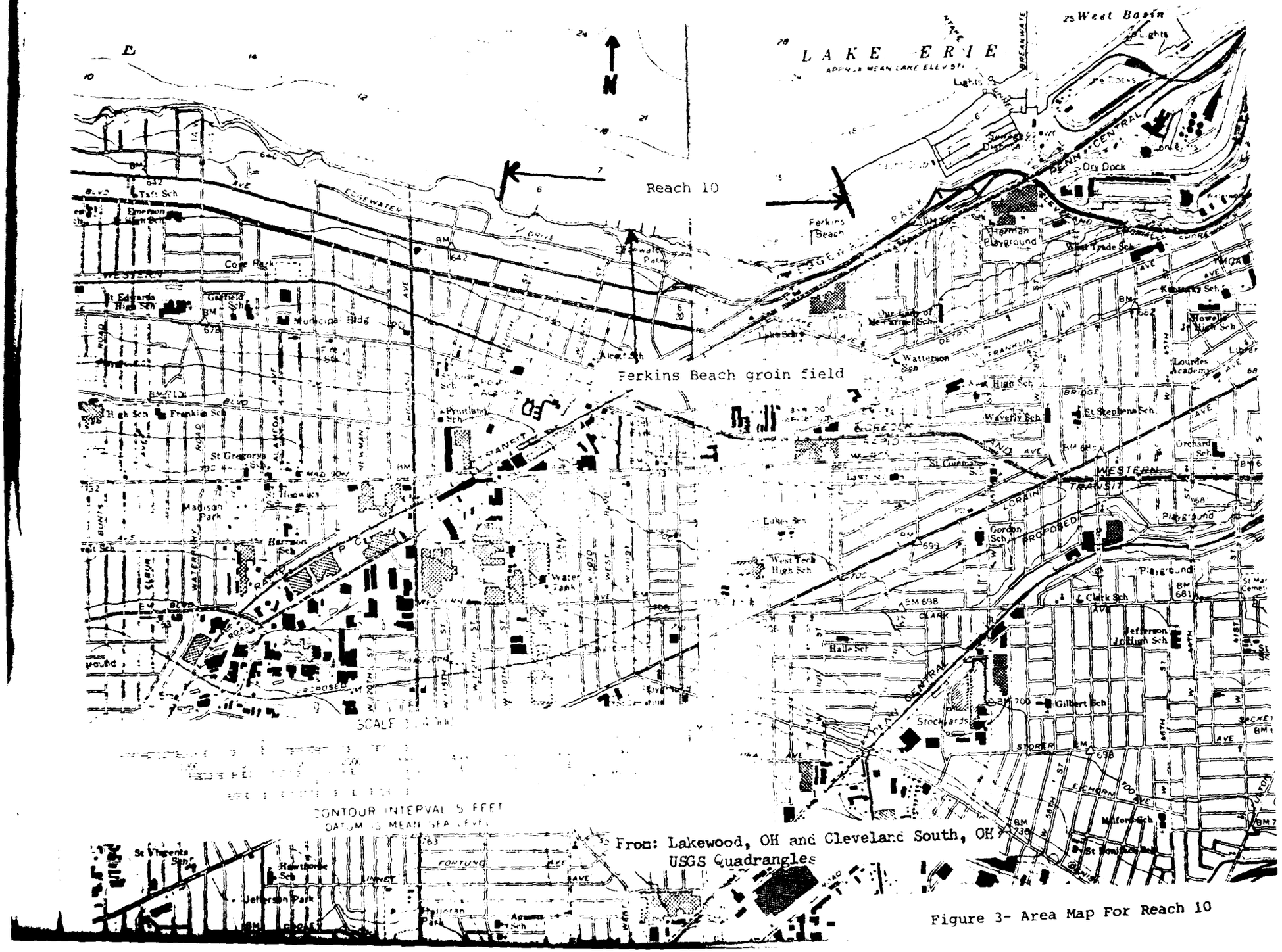


Figure 1- Cleveland Section 111
Study Area Map



From: Cleveland North, OH and East Cleveland, OH USGS Quadrangles

Figure 2- Area Map For Reach 8



From: Lakewood, OH and Cleveland South, OH USGS Quadrangles

Figure 3- Area Map For Reach 10

Table D1 - Summary Matrix for Cleveland Section 111 Study Alternatives

Evaluation Criteria	Alternative IA: No Action Bratenahl		Alternative IB: No Action Perkins Beach		Alternative IIA: Offshore Disposal Bratenahl		Alternative IIB: Offshore Disposal Perkins Beach		Alternative IIIA: Beachfill Bratenahl		Alternative IIIB: Beachfill Perkins Beach		Alternative IVA: Revetment Bratenahl		Alternative IVB: Revetment Perkins Beach	
	Term		Term		Term		Term		Term		Term		Term		Term	
	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long	Short	Long
Natural Environment																
Water Quality	0	0	0	0	-	0	-	0	-	0	-	0	-	0	-	0
Air Quality	0	0	0	0	0/-	0	0/-	0	-	0	-	0	-	0	-	0
Sediment Quality	0	0	0	0	*	*	*	*	0	0	0	0	0	0	0	0
Natural Resources	0	0	0	0	+	+	+	+	-	-	-	-	-	0/-	-	0/-
Endangered Species	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Wetlands	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Benthic Macroinvertebrates	0	0	0	0	-	*	-	*	0/-	0	0/-	0	0/-	+	0/-	+
Plankton	0	0	0	0	-	0	-	0	0/-	0	0/-	0	0/-	0	0/-	0
Fishery	0	0	0	0	-	*	-	*	0/-	0	0/-	0	0/-	+	0/-	+
Vegetation	0	0/-	0	0/-	0	0	0	0	0/-	0/-	0/-	0/-	0/-	0/-	0/-	0/-
Wildlife	0	0	0	0	0	0	0	0	0/-	0/-	0/-	0/-	0/-	0/-	0/-	0/-
Shore Erosion	0/-	-	0/-	-	+	+	+	+	+	+	+	+	+	+	+	+
Human Environment																
Noise	0	0	0	0	0	0	0	0	-	0	-	0	-	0	-	0
Aesthetics	0	-	0	-	0	+	0	+	-	+	-	+	-	+	-	+
Displacement of People	0	-	0	-	0	+	0	+	0	+	0	+	0	+	0	+
Displacement of Businesses	0	-	0	0	0	+	0	0	0	+	0	0	0	+	0	0
Displacement of Farms	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Community Cohesion	0	0/-	0	0/-	0	0/+	0	0/+	0	0/+	0	0/+	0	0/+	0	0/+
Community Growth	0	0/-	0	0/-	0	0/+	0	0/+	0	0/+	0	0/+	0	0/+	0	0/+
Business and Industrial Activity	0	-	0	0	-	0	-	0	+	0	+	0	+	0	+	0
Tax Revenues	0	0/-	0	0/-	0	0	0	0	+	0/+	+	0/+	+	0/+	+	0/+
Property Values	0	-	0	-	0	+	0	+	0	+	0	+	0	+	0	+
Public Facilities	0	0/-	0	-	0	0/+	0	+	0	0/+	0	+	0	0/+	-	+
Public Services	0	0/-	0	-	0	0	0	+	0	0	0	+	0	0	-	+
Employment/Labor Force	0	0	0	0	+	0	+	0	+	0	+	0	+	0	+	0
Man-Made Resources	0	-	0	-	0	+	0	+	0	+	0	+	0/-	+	0/-	+
Recreation	0	-	0	-	0/-	+	0/-	+	0/-	+	0/-	+	0/-	+	0/-	+
Cultural Resources	0	*	0	*	0	0	0	0	*	*	*	*	*	*	*	*

Potential Beneficial Impacts

\+ moderate significance
++ major significance

Potential Adverse Impacts

\- moderate significance
-- major significance

0 no impact, or insignificant impact
* not known at this time

Cleveland Section 111 Shoreline Erosion Study

Project Alternatives

Alternative IA - No Action, Bratenahl

Alternative IB - No Action, Perkins Beach

Alternative IIA - Offshore Disposal of Dredged Sand, Bratenahl*

Alternative IIB - Offshore Disposal of Dredged Sand, Perkins Beach*

Alternative IIIA - Feeder Beachfill, Bratenahl*

Alternative IIIB - Feeder Beachfill, Perkins Beach*

Alternative IVA - Revetment, Bratenahl#

Alternative IVB - Revetment, Perkins Beach#

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* - Denotes nonstructural alternatives (other than "no action").

- Denotes structural alternatives.

NCBED-ER 2 April 1982

MEMORANDUM FOR RECORD

SUBJECT: Sample Collections for Cleveland 111 Sediment Testing

1. Introduction.

a. This report summarizes my activities on 24-25 March 1982 relative to the collection of water and sediment samples for the Cleveland Harbor Section 111 Study. I was accompanied in the field by Ms Joan Pope of the Coastal Engineering Section and Mr. Richard Mammoser of the Western Basin Branch.

2. Field Methods.

Water Samples.

a. Water for elutriate testing was collected on 24 March 1982 from the western tip of riprap shore protection at the White City Sewage Treatment Plant east of Bratenahl, Ohio. The wind and wave direction at the time of collection were from the northwest. (The collection site was therefore updrift of the sewer outfall.) The site was selected due to its close proximity to potential beach nourishment sites at Bratenahl.

b. Five glass quart jars were filled with elutriate water (leaving about 1 inch headspace) and capped with metal lids, lined with Saran wrap. The jars were labeled "elutriate water" and stored on ice in an insulated chest.

Sediment Samples.

c. Sediment samples were collected from the Cuyahoga River Section of the Cleveland Federal Project on 25 March 1982. The samples were obtained by the use of a clamshell dredge operated from the Derrickboat Tonawanda powered by the Tug Stanley. Samples for bulk sediment chemistry and elutriate testing were taken at river survey stations # 819 (Site 1), # 815 (Site 2), and # 812 (Site 3). At each location, the filled clamshell dredge was brought on board the derrickboat, cracked open a few inches, and equal volumes of material from the top, middle, and bottom of the clamshell grab were placed in a clean, plastic bucket. After thorough homogenization, approximately one quart of material from each site was placed in a clean glass jar, which was capped with a metal lid lined with saran wrap, labeled (sediment sample #1, sediment sample #2, or sediment sample #3), and placed on ice in the cooler with the previously collected water samples.

d. At Sites 1, 2, 3, and two additional downriver sites, Joan Pope collected sediment samples with the clamshell dredge to be analyzed by the Ohio River Division for sediment grain size analysis (by seiving and hydrometer) and percent organic matter (by ignition). A general physical description (odor,

Attachment 1

general appearance, etc.) of the sediments from each of the five sites is included in Joan's field report, a copy of which will be attached as Inclosure One. Based on our observations in the field, the greatest quantities of sand in the sediments were found at Sites 1, 2, and 3.

e. Sediments from Sites 1, 2, and 3 were shipped to EG&G Bionomics in Wareham, Massachusetts on 26 March 1982 for bulk chemistry and elutriate testing.

David W. Heicher

DAVID W. HEICHER, Biologist
Environmental Resources Branch

ENVIRONMENTAL (Section)

NCBED-DC 26 April 1982

MEMORANDUM FOR RECORD

SUBJECT: Cleveland III Sampling Sediments from the Cuyahoga River

1. On 24-26 March 1982, Richard Mammoser, David Heicher, and Joan Pope conducted various investigations in the Cleveland Area in support of the Cleveland Section III Study. These investigations included inspections of various points along the study shoreline, discussions with Cuyahoga County and Bratenahl Village officials regarding the availability of historical data, and sediment sampling in the upper reaches of the Federal navigation channel of the Cuyahoga River.

2. Points visited along the study shore includes most reaches but were confined to points of ready public access. All Stops are listed in Incl 1 along with notes of specific interest.

3. A visit to the Cuyahoga County Engineers Office of Records provided some promises of obtaining future data via aerial photos from the late 1920's and early survey plats of the shores of specific interest. The 1923's aerials had been rendered useless for our study purposes as the approximate shoreline had been trimmed for mounting. Apparently, the original negatives of flight are no longer available. A check with Western Reserve Historical Association suggests that later 1920's photos exist and the County Engineer's Office will check on these for us and for their own interest. A complete set of 1949 aerials is available from the county and they will research the plats for us. Discussion with the Bratenahl Village Police Chief reveal that erosion is a serious problem which many homeowners attempt to keep up with by dumping landfill. Old breakwaters lose elevation and sink out of sight apparently due to foundation problems. A group of homeowners combined efforts to put in a quarter million dollar concrete seawall which, within 2 1/2 years was "falling over." Police Chief Richard Gross also stated that the sand fillet at White City Park was dredged out about 15 years ago producing significant quantities of sand for the Inner State Highway System. During a telephone conversation with Sy Weitz, who is the Bratenahl Village Engineer, he indicated that any old plats, surveys, maps, etc., of the Bratenahl shore are stored by Cuyahoga County. The oldest data he has is a County Sewer Authority topography survey done in the mid 1960's.

Attachment 2

NCBED-DC
SUBJECT: Cleveland III Sampling Sediments from the Cuyahoga River

4. Five samples of the Cuyahoga River sediments were obtained using the Tug STANLEY and the Derrickboat TONAWANDA. A clam bucket was dropped in mid-channel and the 4-foot to 7-foot thick sample was brought to the derrickboat deck where a representative sample could be collected from the bucket. A representative sample involved extracting equal amounts from the top, middle, and bottom of the bucket. A listing of the samples and description is given in Incl 2. Grain size analysis will be completed on each sample. Environmental parameter testing will be conducted only of samples 1 through 3. Preliminary field evaluation suggests that sediment from Stations 820-810 are the only place where sand of any significance can be found.

2 Incl
as stated

JOAN POPE
Geologist
Coastal Engineering Section

Cleveland III Study
24-26 March 1982
Investigation of Shore Points

1. Reach 1 - Watergate Apartments (near center reach). A very large two building apartment complex on an approximately 30-foot high till bluff. Bluff unstable due to seepage and rapid toe erosion. Driveway to parking garage overhangs the bluff and has been protected by "Staked" Campbell units within the past year. Units are already being pushed forward by the soil pressure of bluff. Slope failure cracks evident at top of bluff at edge of drive. Protection for main apartment complex and parking garage is poor, dumped, undersized concrete rubble.

2. Reach 2 - Americana Apartments. Middle group of apartments of 3 separate complexes (each with two buildings). Similar condition to that of Watergate Apartments but parking garage at backside of Apartments is not overhanging the bluff. No protection other than dumped, undersized, rubble. Again, is an unstable, activity eroding bluff.

3. Reach 2 - Moss Point Storm Sewer Outfall. Public access via walkway on top of a drainage conduit to a stickout feature (pier). Some sand buildup on west side.

4. Reach 2/Reach 3 - Euclid Park (at foot of Babbitt Road) Public Park and beach. Stone jetties on either side of a storm outfall have trapped a wide (100-foot) beach on the west side and a narrower (25-foot) beach on the east side.

5. Reach 3 - West end of Edgecliff Drive at community access point. Heavily protected shore. Campbell units constructed into a groin on either side of an outfall.

6. Reach 4 - St. Joseph's High School, raw eroding, 25-foot high, till bluff, over which a lot of trash has been dropped as fill.

7. Reach 5 - Wildwood Park.

8. Reach 6 - Former location of Euclid Beach Park. Original groin field is badly deterioratd but still maintains a stable beach. Sand throughout this area toward the east and Euclid Creek. Bluff is heavily vegetated and has a stable slope.

9. Reach 7 - White City Park/Sewage Disposal Facility. Public access to White City Park Beach no longer available. Material being used to fill in behind the breakwater is upland material. Beach within breakwaters is vegetated and of well sorted-fine sand.

10. Reach 8 - Lake Shore Country Club. New apartment complex just east of Dugway Brook. Bluff face regroomed and terraced. Assorted rubble protection.

11. Reach 8 - Foot of Bratenahl Road. High, unvegetated, heavily eroding bluff.

12. Reach 10 - Perkins Beach. Highly deteriorated permeable groins do not hold much sand. Bluff is unstable and sloughing due to seepage. Road to west has been lost. Road to east is endangered as slope failure fractures have opened at road edge. Seepage failure continuing although toe is not removed rapidly thanks to the remnant groin field. Bluff material becomes shale immediately west of this site.

13. Reach 12 - Gold Coast. Very soft shale bluffs with large apartment complexes built up to the bluff edge.

Cleveland III Study
25 March 1982 Sampling of the Cuyahoga River Sediments

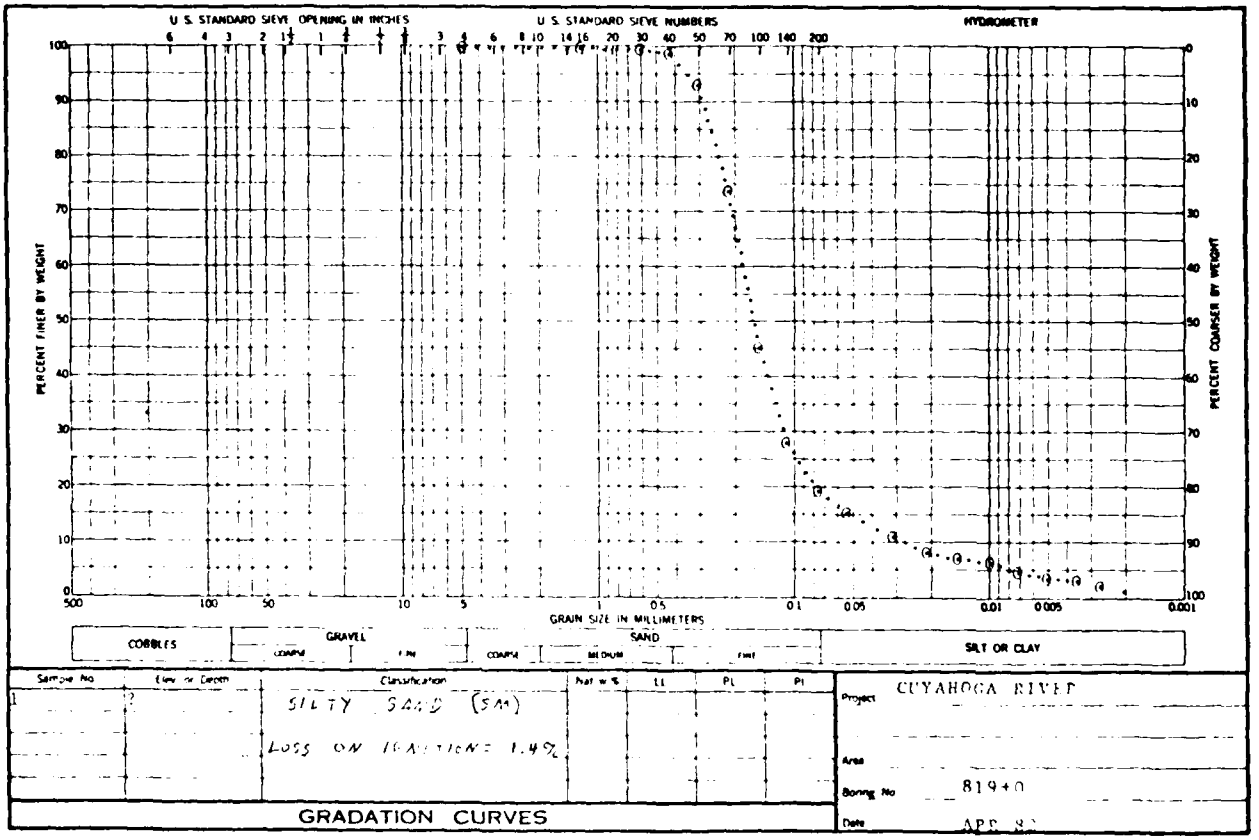
Sample No. 1 Station 819+0. Water depth measured at 19 feet 3 inches, thickness of sample is over 4 feet. Material is a silty fine sand with some oil and septic odor. Sample is relatively clean with some organic fragments and small amounts of clay lenses.

Sample No. 2 Station 815+0 (sample location approximately 25 feet south of channel centerline). Water depth measured at 20 feet 10 inches and sample thickness is approximately 5 feet. Material is a silty fine sand with some clay lenses and oil. Organic material is primarily layers of leaves and twigs. The sand is clean at top and more silty at the bottom.

Sample No. 3 Station 812-0. Water depth measured at 20 feet 4 inches and sample thickness is approximately 6 feet. Material is a clayey silty fine sand which is sandier toward the top and clayer toward the bottom. This sample contains more silt content than previous samples and has a slightly more septic odor.

Sample No. 4 Station 810+0. Water depth measured at 22 feet 2 inches and the sample thickness is approximately 6 feet. Material is a silty-clay with minor amounts of sand and a stronger septic odor. Material is layered with sand, and clay zones and organic rich layers of leaves. Material is reducing and gaseous.

Sample No. 5 Station 805+0. Water depth measured at 20 feet-5 inches and approximate thickness of the sample is 7 feet. Sample included a log at the top and exhibited a tendency for layering. The top layer was 2 feet thick clay layer with organic rich leaf zones. In the middle was a sandy silt layer approximately 2 feet thick and the lower portion of the sample contained a consistent reducing, black-organic-rich, clay layer with a strong septic odor. Material is reducing and gaseous.



ENG FORM 1 MAY 83 2087

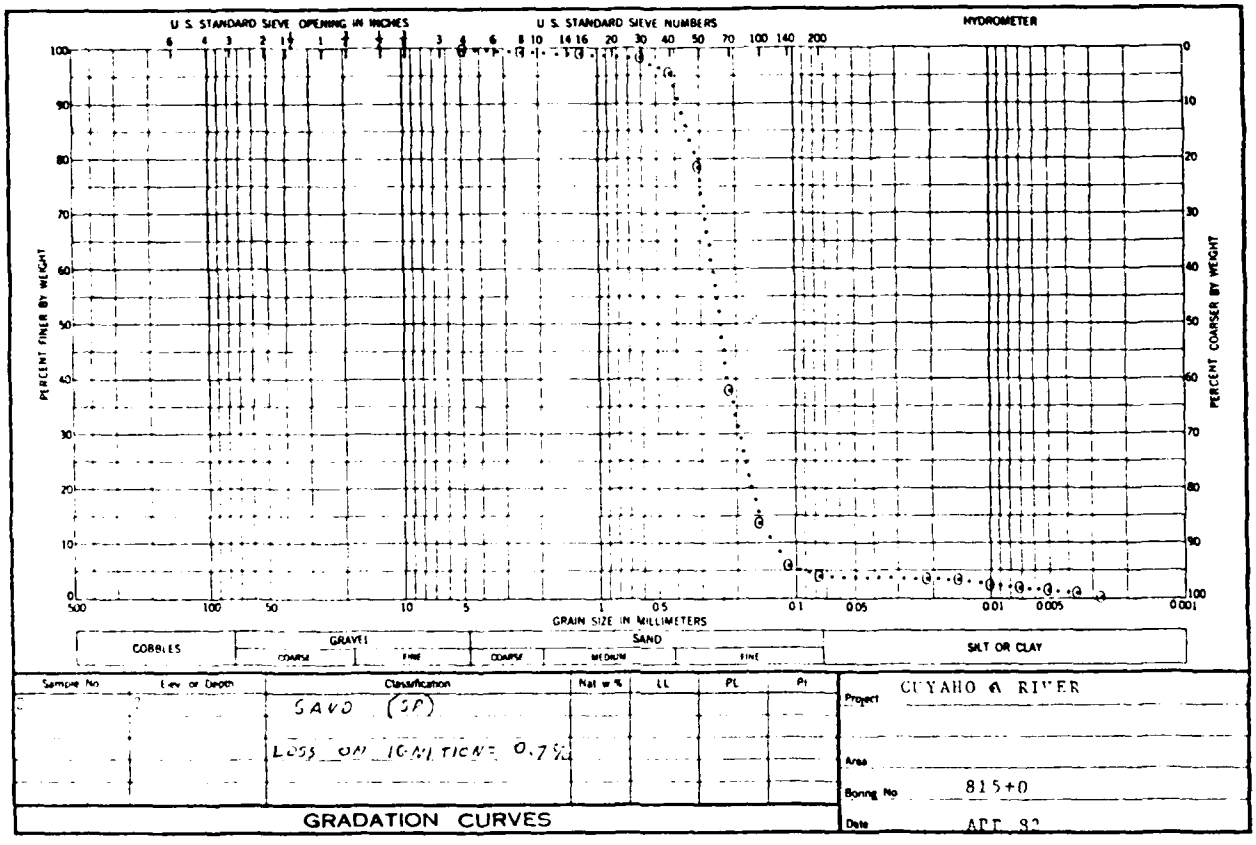
SIEVE ANALYSIS

US Standard Sieve Size or Number	Percent Finer By Weight	US Standard Sieve Size or Number	Percent Finer By Weight
3 in	.....	No 6	.....
2 in	.....	No 8	.....
1 ½ in	.....	No 12	.....
1 in	.....	No 16	099.[illegible]
¾ in	.....	No 20	.....
½ in	.....	No 30	099.[illegible]
⅜ in	.....	No 40	09[illegible].95
No 3	.....	No 50	093.39
No 4	100.00	No 70	073.[illegible]
		No 100	065.[illegible]
		No 140	02[illegible].[illegible]
		No 200	019.[illegible]

HYDROMETER ANALYSIS

PARTICLE DIAMETER	TOTAL % FINER
0.0186	15.81
0.0084	11.29
0.0090	08.68
0.0130	07.29
0.0099	06.77
0.0064	05.03
0.0045	03.99
0.0032	03.47
0.0024	02.60

Attachment 3- Results of Grain Size Analyses o
Cuyahoga River Sediments



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
		SAND (SP)				
		LOSS ON IGNITION = 0.7%				

Project: CUYAHO A RIVER

Area:

Boring No: 815+0

Date: APR 82

GRADATION CURVES

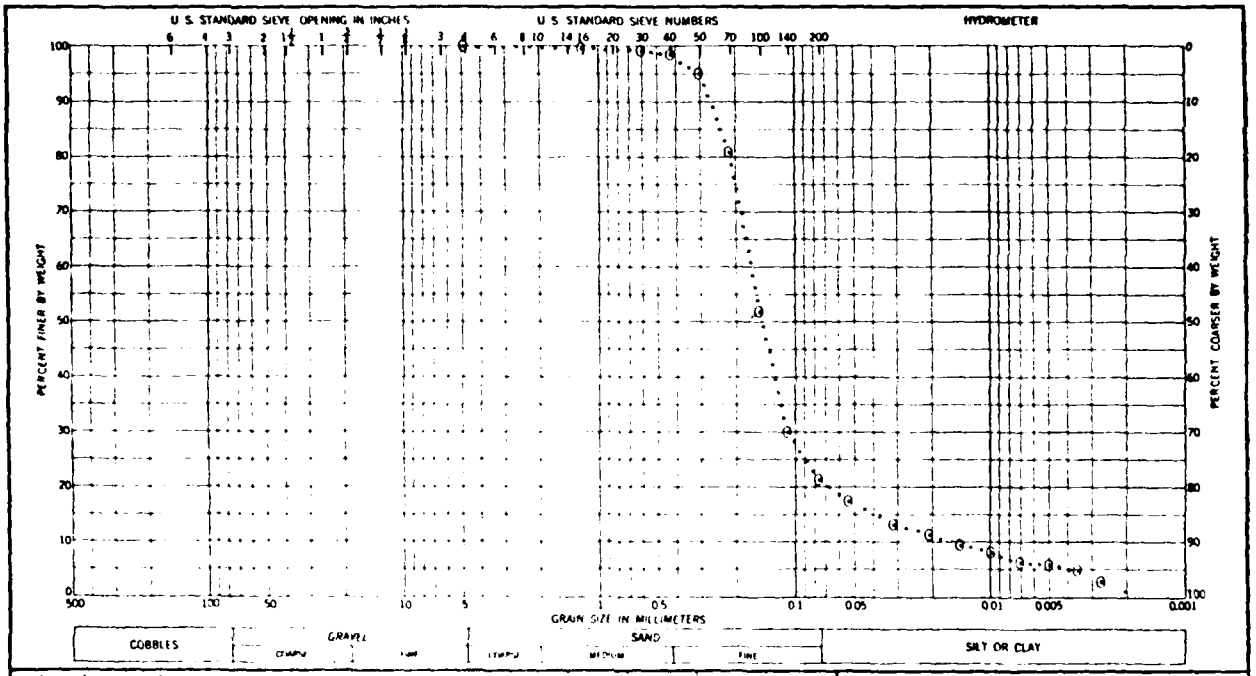
ENG FORM MAY 81 2087

SIEVE ANALYSIS

US Standard Sieve Size or Number	Percent Finer By Weight	US Standard Sieve Size or Number	Percent Finer By Weight
3 in	.....	No 6	.....
2 in	.....	No 8	099.47
1 ½ in	.....	No 12	.....
1 in	.....	No 16	099.12
¾ in	.....	No 20	.....
½ in	.....	No 30	098.43
⅜ in	.....	No 40	095.99
No 3	.....	No 50	079.74
No 4	100.00	No 70	038.31
		No 100	013.91
		No 140	006.24
		No 200	004.33

HYDROMETER ANALYSIS

PARTICLE DIAMETER	TOTAL % FINER
.....	.....
.....	.....
0.0194	03.83
0.0133	03.65
0.0091	02.78
0.0064	02.26
0.0046	01.74
0.0032	01.21
0.0024	00.52



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
3	?	SILTY SAND (SM) WITH TRACE OF CLAY LESS THAN 15%		(VISUAL)		

Project: CUYAHOGA RIVER
Area:
Boring No: 812+0
Date: APR 82

GRADATION CURVES

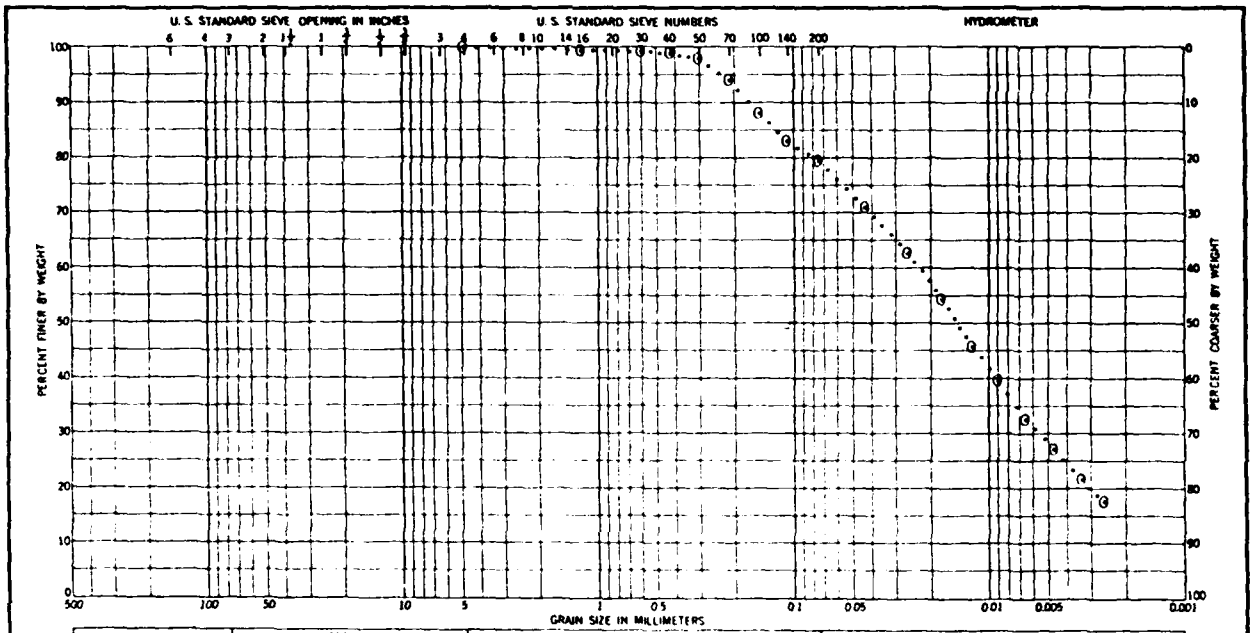
ENG FORM (MAY 68) 2087

SIEVE ANALYSIS

U S Standard Sieve Size or Number	Percent Finer By Weight	U S Standard Sieve Size or Number	Percent Finer By Weight
3 in	.....	No 6	.....
2 in	.....	No 8	.....
1 ½ in	.....	No 12	.....
1 in	.....	No 16	.....
¾ in	.....	No 20	.....
½ in	.....	No 30	.....
⅜ in	.....	No 40	.....
No 3	.....	No 50	.....
No 4	100.00	No 70	.....
		No 100	.....
		No 140	.....
		No 200	.....

HYDROMETER ANALYSIS

PARTICLE DIAMETER	TOTAL % FINER
0.0485	17.57
0.0283	13.22
0.0188	11.40
0.0129	08.58
0.0089	08.03
0.0063	06.16
0.0045	05.79
0.0032	04.86
0.0024	02.99



Sample No	Elev. or Depth	Classification	Nat w %	LL	PL	PI
		ORGANIC SANDY CLAY (OL)		(VISUAL)		
		LOSS ON IGNITION = 5.0%				

GRADATION CURVES

Project: CUYAHOGA RIVER
Area:
Boring No.: 810+0
Date: APR 82

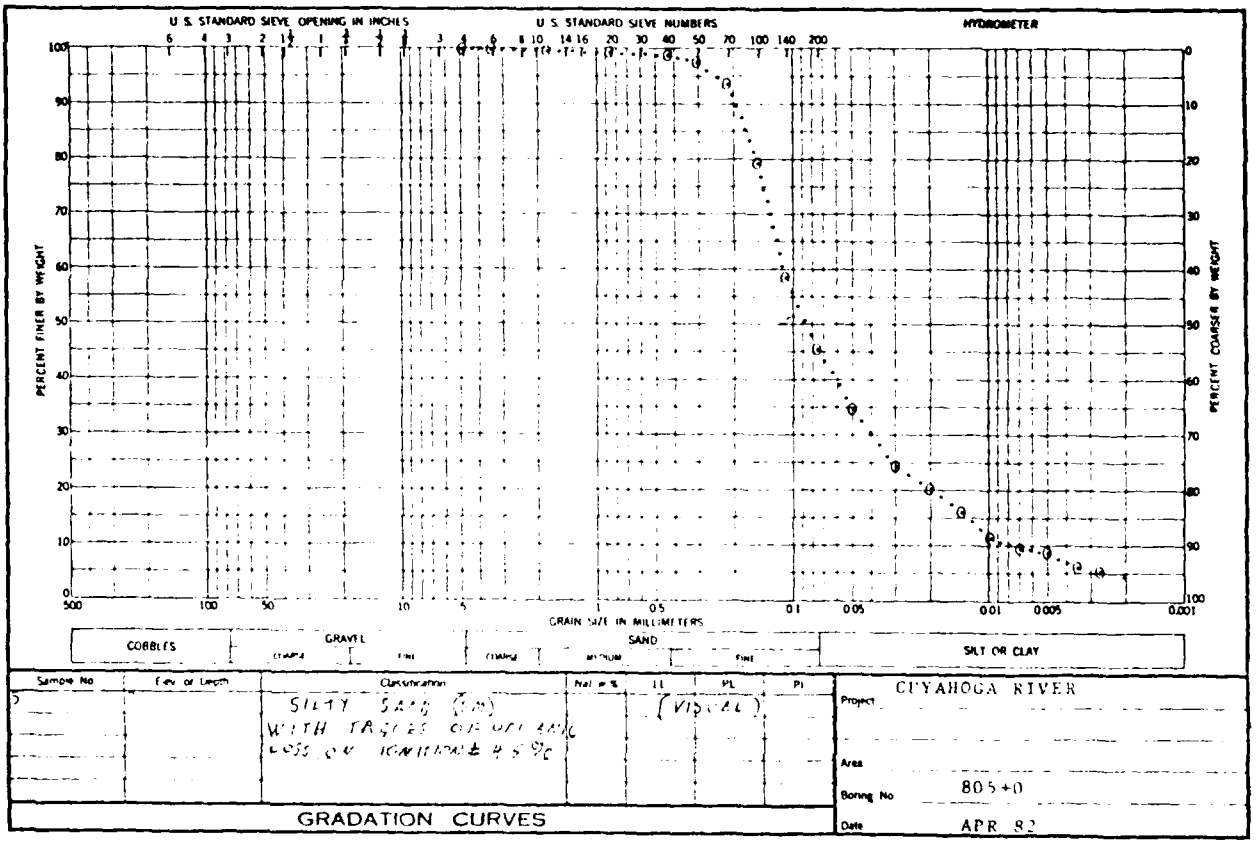
ENG FORM 1 MAY 63 2087

SIEVE ANALYSIS

US Standard Sieve Size or Number	Percent Finer By Weight	US Standard Sieve Size or Number	Percent Finer By Weight
3 in	.....	No 6	.....
2 in	.....	No 8	.....
1 ½ in	.....	No 12	.....
1 in	.....	No 16	099.42
¾ in	.....	No 20	.....
½ in	.....	No 30	099.23
⅜ in	.....	No 40	098.85
No 3	.....	No 50	097.90
No 4	100.00	No 70	094.29
		No 100	088.21
		No 140	083.08
		No 200	079.66

HYDROMETER ANALYSIS

PARTICLE DIAMETER	TOTAL % FINER
0.0397	71.06
0.0239	62.89
0.0160	54.53
0.0110	45.79
0.0081	39.71
0.0058	32.68
0.0042	27.17
0.0030	21.47
0.0023	17.67



Sample No	Elev or Depth	Classification	Nat w %	LL	PL	PI
		SILTY SAND (SM) WITH TRACES OF ORGANIC LOSS ON IGNITION ± 4.5 %		(NP)		

GRADATION CURVES

Project: CUYAHOGA RIVER

Area:

Boring No: 805+0

Date: APR 82

ENG FORM 1 MAY 63 2087

SIEVE ANALYSIS

US Standard Sieve Size or Number	Percent Finer By Weight	US Standard Sieve Size or Number	Percent Finer By Weight
3 in	.....	No 6	099.81
2 in	.....	No 8	.....
1 ½ in	.....	No 12	099.45
1 in	.....	No 16	.....
¾ in	.....	No 20	099.09
½ in	.....	No 30	.....
⅜ in	.....	No 40	098.73
No 3	.....	No 50	098.40
No 4	100.00	No 70	098.06
		No 100	097.39
		No 140	096.39
		No 200	095.56

HYDROMETER ANALYSIS

PARTICLE DIAMETER	TOTAL % FINER
0.0454	34.73
0.0272	24.24
0.0180	20.26
0.0125	16.09
0.0098	11.39
0.0063	09.58
0.0044	08.50
0.0031	06.15
0.0024	05.42

EG&G

Attachment 4- Results of Bulk Chemical Analyses and Elutriate Tests of Cuyahoga River Sediments

BULK CHEMICAL ANALYSIS OF SEDIMENT SAMPLES COLLECTED FROM CLEVELAND HARBOR, OHIO.

RESEARCH REPORT

SUBMITTED TO

U.S. ARMY ENGINEERING DISTRICT, BUFFALO

1776 NIAGARA STREET

BUFFALO, NEW YORK 14207

IN FULFILLMENT OF

WORK ORDER NO. 6

CONTRACT NO. DACW-49-81-D0010

EG&G, Bionomics
790 Main Street
Wareham, Massachusetts 02571

BIONOMICS NO. D99-450

TABLE OF CONTENTS

INTRODUCTION

In fulfillment of Work Order No. 6, Contract #DACW-49-81-D-0010 (Appendix A), EG&G, Bionomics procured three surface sediment and three water samples from Cleveland Harbor. Samples were collected by personnel from U.S. Army Corps of Engineers, Buffalo District and shipped in refrigerated (ice packs) styrofoam containers to EG&G, Bionomics, Wareham, Massachusetts for bulk chemistry analysis. All samples arrived at the analytical chemistry laboratory on 29 March 1982 in 1-liter glass jars. The jars were removed from the styrofoam containers, sample identification recorded in the incoming sample log, and each sample refrigerated at $4^{o}C$ until analysis.

SAMPLE PREPARATION

Initially, each sediment sample was brought to room temperature, thoroughly agitated to insure homogeneity and then divided into two subsamples for analysis. One subsample was utilized (with the water samples) for the elutriate test and a second subsample was used for the bulk chemistry analyses in sediment (i.e., selected trace metal, inorganic and organic parameters).

TRACE METAL ANALYSES

Each sediment sample for trace metals analysis was divided into three aliquots. One aliquot was digested for arsenic, cadmium,

chromium, copper, iron, lead, manganese, nickel and zinc (U.S. EPA, 1979a), for atomic absorption spectrophotometry (AAS). A second aliquot was digested for mercury by a modified U.S. EPA (1979a, 1979b) method for AAS. A third aliquot was used for percent moisture determination. In addition, four water samples, three elutriate test water samples and one process water sample (for background determination), were divided into two aliquots and digested with the sediment samples. The analytical results for the sediments were calculated using the dry weight of each sediment. All samples were analyzed via AAS by electrothermal atomization (As), flame atomization (Cd, Cr, Cu, Fe, Pb, Mn, Ni, Zn) or cold vapor generation (Hg) utilizing the instrumental conditions listed in Table 1.

Calibration curves were obtained by plotting response (mm, peak height) versus concentration of calibration standards in distilled deionized water. One standard was analyzed every 5 samples.

The minimum detectable concentrations of each metal in these sediments and elutriate test waters are presented in Table 2. The analytical results are presented in Tables 3 and 4. Quality assurance samples were digested and analyzed under the same conditions as the test samples. Analytical results for the quality assurance samples are presented in Table 5.

INORGANIC ANALYSIS

Three sediment samples and three elutriate test water samples were analyzed for the following (7) parameters:

1. chemical oxygen demand (COD)
2. volatile solids (%)
3. Kjeldahl nitrogen (TKN)
4. ammonia nitrogen
5. oil and grease
6. total phosphorous
7. cyanide

The elutriate test water samples were not analyzed for volatile solids or oil and grease. The samples were prepared and analyzed according to procedures outlined by EPA (1979a, 1979b). The analytical results for the sediment samples are presented in Table 6 and the analytical results for the elutriate test water samples are presented in Table 7.

ORGANIC ANALYSIS

Three sediment samples were prepared for analysis utilizing the following procedures (U.S. EPA, 1979a, 1980). Aluminum foil was rinsed with acetone to remove potential organic contamination, folded to form a crude tray, placed over a layer of absorbent paper, and punctured several times to allow bulk water to drain

from the sample. Sediment samples were placed in the aluminum foil tray and air-dried for a 24-hour period. Two samples, an analytical sample and a subsample for moisture determination, were withdrawn and accurately weighed in tared beakers. The subsample was dried at 103-105°C for two hours, cooled, and re-weighed to calculate the weight of the analytical sediment sample on a dry-weight basis. All analytical results were calculated and reported on the dry-weight basis.

Sediment samples for pesticides and polychlorinated biphenyl (PCB) analyses were air-dried, weighed, placed in a 43 x 123 mm fat free cellulose extraction thimble, capped with a layer of glass wool and placed in a Soxhlet extraction apparatus for ca. 16 hours with 1:1 (V:V) acetone in hexane, according to U.S. EPA (1975, 1979a, 1980).

Based upon historical literature values for the complete percentage recovery of various organochlorine pesticides from sediment (U.S. EPA, 1975), a complete extraction of pesticides and PCB's was assumed for this work.

Sediment extracts were reduced in volume to approximately 5 mℓ by Kuderna-Danish (K-D) evaporation, then brought up with hexane to a 10 mℓ volume in a volumetric flask. A 3 mℓ aliquot was transferred to 0.9 x 25 cm pyrex chromatographic column containing ca. 6 g of activated (130°C) Florisil 60/100 mesh with

a 1 cm layer of anhydrous sodium sulfate above it. The column was pre-rinsed with 50 mℓ of hexane before sample application.

The column was first eluted with a 50 mℓ volume of 6% diethyl ether in hexane to remove PCB's and various pesticides. The column was then eluted with a 50 mℓ portion of 50% diethyl ether in hexane. The 6% diethyl ether in hexane fraction and the 50% diethyl in hexane fraction were concentrated to 5.0 mℓ for gas chromatographic analysis. If further clean-up was required, a 3 mℓ aliquot of 6% diethyl ether/hexane Florisil fraction was transferred to a 0.9 x 25 cm pyrex chromatographic column, containing ca. 5 g of deactivated Silica Gel. To deactivate the Silica Gel (S.G.), the activated (at 180°C) S.G. was tranferred to a glass stoppered bottle and after cooling was mixed with distilled water (1% by weight). The sample was eluted with 2 portions of 50 mℓ of hexane. Both fractions were concentrated to 5 mℓ for GC analysis.

Gas chromatographic analyses were performed using the following instrumental conditions:

Instrument: Hewlett-Packard 5840 gas chromatograph equipped with Ni-63 Electron Capture detector and automated sampler

Column: 6' x 2 mm (ID) Pyrex packed with 3% OV-101 on 80/100 mesh Supelcoport

Temperatures (°C): column - 190, inlet- 250, detector - 300

Gas Flows: 30 mℓ/min. 5% methane/95% argon

Chart Speed: 1.0 cm/min.

Attenuation: 64

Analytical standards were prepared by dilution of analytical pesticide and PCB standards with isooctane to yield working standards of the required concentrations. A mixed standard was used for the pesticides quantitated. Separate analytical standards were used for Endrin, Mirex, Toxaphene, Chlordane and Aroclors 1016, 1242, 1254 and 1260. Aroclors 1016, 1242, 1254 and 1260, Toxaphene and Chlordane were quantitated based on major isomer peaks.

Based on an approximate sample size of 10 grams (dry weight) and the analytical standards utilized, the compounds of interest were not detected in the sediment samples at a theoretical concentration of 0.3 mg/kg. Analysis of the three (3) sediment samples, blanks and replicate sample did not reveal the presence of any of the compounds of interest. A series of quality assurance samples were analyzed concurrently with the sediment samples. These results are presented in Table 8.

LITERATURE CITED

APHA. 1975. Standard Methods for the Examination of Water and Wastewater. 14th Edition, American Public Health Association, Washington, D.C.

Federal Register. 1979. Environmental Protection Agency Guidelines Establishing Test Procedures for the Analysis of Pollutants. Proposed Regulations. Federal Register, 3 December 1979, 44(233).

U.S. EPA. 1975. A Review of Concentration Techniques for Trace Chemicals in the Environment. Office of Toxic Substances, Washington, D.C. PB-247-946.

U.S. EPA. 1979a. Chemistry Laboratory Manual for Bottom Sediments and Elutriate Testing, U.S. EPA, Chicago, IL, EPA-905/4-79-014, PB-294596.

U.S. EPA. 1979b. Methods for Chemical Analyses of Water and Wastes. U.S. EPA, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio. EPA-600/4-79-020.

U.S. EPA. 1980. Manual of Analytical Methods for the Analysis of Pesticides in Humans and Environmental Samples. Health Effects Laboratory, Research Triangle Park, North Carolina. EPA-600/8-80-038.

Table 1. Instrumental operating conditions used in the determination of selected trace metals in sediment and elutriate test water samples from Cleveland Harbor.

	Perkin-Elmer Model 2380 Atomic Absorption Spectrophotometer Conditions								Flame Conditions		Furnace Conditions		
Element	Wavelength (nm)	Slit width (nm)	Range (mV)	Scale expansion	Source lamp	Lamp current	Chart speed (mm/min)	Gas flow (mℓ/min)	Fuel (flow)	Oxidant (flow)	Temperature (°C)		Time (sec)
Arsenic	193.7	0.7	20	3.632	As[a]	8	40	50	-[c]	-	dry	130	30
											char	700	15
											atomization	2700	8
Cadmium	228.8	0.7	2.0	0.5156	Cd[a]	5	40	-	C_2H_2 (20)	air (45)		-	-
Chromium	357.9	0.7	5.0	0.2355	Cr[b]	25	40	-	C_2H_2 (20)	air (40)		-	-
Copper	324.7	0.7	5.0	2.096	Cu[b]	15	40	-	C_2H_2 (20)	air (45)		-	-
Iron	248.3	0.2	1.0	0.2948	Fe[b]	30	40	-	C_2H_2 (20)	air (45)		-	-
Lead	283.3	0.7	2.0	1.014	Pb[a]	10	40	-	C_2H_2 (20)	air (45)		-	-
Manganese	279.5	0.2	1.0	0.1149	Mn[b]	20	40	-	C_2H_2 (20)	air (45)		-	-
Mercury	253.7	0.7	2.0	0.7622	Hg[a]	5	10	20	-	-		-	-
Nickel	232.1	0.2	5.0	3.302	Ni[b]	25	40	-	C_2H_2 (20)	air (45)		-	-
Zinc	213.9	0.7	5.0	0.4843	Zn[a]	6	40	-	C_2H_2 (20)	air (45)		-	-

[a] Electrodeless Discharge Lamp - current in watts.

[b] Hollow Cathode Lamp - current in milliamperes.

[c] Not applicable.

Table 2. Minimum detectable concentrations of selected trace metals in sediments and elutriate test waters from Cleveland Harbor.

Element	Concentration	
	water (µg/ℓ)	sediment (µg/g)
Arsenic	3.2	0.35
Cadmium	35	3.8
Chromium	190	21
Copper	110	12
Iron	89	9.6
Lead	37	4.1
Manganese	190	21
Mercury	0.26	0.0054
Nickel	33	3.6
Zinc	130	14

Table 3. Analytical results for selected trace metals in Cleveland Harbor sediment samples.

Sample Identification	Concentration (µg/g)									
	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Zinc
COE-D99-001 A	11	< 3.8	< 21	65	17600	14	250	0.11	8.9	160
COE-D99-001 B	11	< 3.8	< 21	74	17500	< 4.1	250	0.12	11	170
COE-D99-002	11	< 3.8	< 21	61	18400	14	290	0.20	19	290
COE-D99-003	11	< 3.8	23	81	22700	26	300	0.25	21	300

Table 4. Analytical results for selected trace metals in Cleveland Harbor elutriate test water samples.

Sample Identification	Concentration (µg/ℓ)									
	Arsenic	Cadmium	Chromium	Copper	Iron	Lead	Manganese	Mercury	Nickel	Zinc
COE-D99-001 A	4.9	60	< 190	< 110	610	37	1500	1.6	< 33	4900
COE-D99-001 B	8.2	43	< 190	< 110	390	37	1500	< 0.26	< 33	7100
COE-D99-002	3.2	< 35	< 190	< 110	220	37	1500	0.74	< 33	3800
COE-D99-003	5.7	35	< 190	< 110	350	< 37	2500	0.26	< 33	2100
Elutriate process water	< 3.2	140	< 190	< 110	< 89	< 37	< 190	< 0.26	< 33	< 130

Table 5. Analytical results for quality assurance samples analyzed with Cleveland Harbor sediment samples.

Element	Concentration (µg/g)			
	National Bureau of Standards River Sediment 1645		EPA Municipal Digested Sludge	
	Theoretical	Measured	Theoretical	Measured
Arsenic	66[a]	74	16.972	4.755
Cadmium	10.2	6.9	20.772	16.857
Chromium	29600	27005	204.46	178.99
Copper	109	109	1095.3	1080.3
Iron	113000	95800	16155	17635
Lead	714	690	518.76	523.70
Manganese	785	684	204.98	207.28
Mercury	1.1	1.3	16.315	16.239
Nickel	45.8	35.5	198.31	188.40
Zinc	1720	1710	1323.1	1389.7

[a] Value not certified.

Table 6. Analytical results for selected inorganic parameters in Cleveland Harbor sediment samples.

	Sample Identification (COE-D99)			
	001A	001B	002	003
Volatile solids (%)	2.3	2.4	4.5	3.9
Ammonia nitrogen (mg/kg-dry)	1.9	0.53	1.1[a]	1.6
COD (mg/kg dry)	80	120	55[a]	96
Total cyanide (mg/kg-dry)	<1.0	<1.0	<1.0	<1.0
Total phosphorus (mg/kg-dry)	1.4	1.5	1.4[a]	2.2
Oil and grease (mg/kg-dry)	574	242	795	1825
Total Kjeldahl nitrogen (mg/kg-dry)	2.1	1.9	1.0[a]	1.8

[a] Mean of two replicate analyses.

Table 7. Analytical results for selected inorganic parameters in Cleveland Harbor elutriate test water.

	Sample Identification (COE-D99)			
	001A	001B	002	003
Ammonia nitrogen (mg/ℓ)	0.47	0.89	2.7	3.7
COD (mg/ℓ)	30[a]	130	245	630
Total cyanide (mg/ℓ)	<0.005	<0.005	<0.005	<0.005
Total phosphorus (mg/ℓ)	0.31	0.35	0.29	0.29
Total Kjeldahl nitrogen (mg/ℓ)	11	14	9.1	25

[a] Mean of two replicate analyses.

Table 8. Analytical results for quality assurance samples analyzed with Cleveland Harbor sediment samples.

Sample identification	Parameter	Concentration (mg/kg) Theoretical	Measured	% Recovery
COE D99-001 (spiked)	p,p'-DDT	1600	1220	76
	Aroclor 1016	1700	1580	89
COE D99 Lab control (spiked)	p,p'-DDT	1600	980	61
	Aroclor 1016	1770	1110	63

APPENDIX "A"
SCOPE OF WORK
FOR
SEDIMENT TESTING
CLEVELAND HARBOR, OHIO

1. Analyses

1.1 The Contractor will conduct bulk chemical analyses and elutriate tests on each of three samples to be supplied by the Buffalo District. The Buffalo District will also supply water to be used for the elutriate tests. Parameters to be measured for bulk analysis shall include the following:

Volatile Solids	Organics
COD	Mirex
TKN	DDT
Oil and Grease	Chlordane
Lead	Aldrin/Dieldrin
Zinc	Endrin
Ammonia-N	Heptachlor
Cyanide	Heptachlor Epoxide
Total P	Lindane
Iron	Toxaphene
Nickel	PCB's
Manganese	
Arsenic	
Cadmium	
Chromium	
Copper	
Mercury	

The above parameters shall also be included in elutriate tests except for Volatile Solids, Oil and Grease, and the list of Organics.

2. Analytical Procedures

2.1 All methods of sample preparation, digestion, and analyses should be as described below. Alternative procedures must be contained in the offeror's proposal and approved by the Corps Project Officer in the event of a contract award. Suggested procedures for sediment and water testing are contained in the following:

a. "Chemistry Laboratory Manual for Bottom Sediments and Elutriate Testing", EPA-905/--79-01-, March 1979 (WTIOPE-C9-596).

b. "Guidelines Establishing Test Procedures for the Analysis of Pollutants", Part 40 CFR, Part 136, Federal Register V. 44, No. 233, 16 Dec 79.

c. Method 601, 40 CFR, Part 136, Federal Register V. 44, No. 233, 3 Dec 79.

3. Quality Control

3.1 Standard good practices of quality assurance will be implemented by the Contractor to assure reliability of analytical results. The quality assurance protocol employed including results of blanks, standards, spikes and duplicates should be included in the final report.

4. Schedule and Reporting

4.1 A final report containing tabulated analytical results, referenced analytical methods, and quality control protocol and related data should be submitted to the Corps project officer within 6 weeks of permission to proceed.

AMENDMENT OF SOLICITATION/MODIFICATION OF CONTRACT

PAGE 1 OF 1

2 AMENDMENT/MODIFICATION NO.	3 EFFECTIVE DATE	4 REQUISITION/PURCHASE REQUEST NO.	5 PROJECT NO. (If applicable)
Work Order No. 6	82 APR 02		Cleveland, Section 111

6 ISSUED BY	CODE	7 ADMINISTERED BY (If other than block 6)	CODE
Department of the Army U. S. Army Engineer District, Buffalo 1776 Niagara Street Buffalo, NY 14207			

8 CONTRACTOR NAME AND ADDRESS (Street, city, county, state, and ZIP Code) CODE FACILITY CODE

E G & G Bionomics
790 Main Street
Wareham, Plymouth Co., MA 02571

9A. ☐ AMENDMENT OF SOLICITATION NO. _____

DATED _____ (See block 9)

9B. ☒ MODIFICATION OF CONTRACT/ORDER NO. DACW49-81-D-0010

DATED 81 MAY 26 (See block 11)

10 THIS BLOCK APPLIES ONLY TO AMENDMENTS OF SOLICITATIONS

☐ The above numbered solicitation is amended as set forth in block 12. The hour and date specified for receipt of Offers ☐ is extended ☐ is not extended.

Offerors must acknowledge receipt of this amendment prior to the hour and date specified in the solicitation by or as amended, by one of the following methods:

(a) By signing and returning _____ copies of this amendment; (b) By acknowledging receipt of this amendment on each copy of the offer submitted; or (c) By separate letter or telegram which includes a reference to the solicitation and amendment numbers. FAILURE OF YOUR ACKNOWLEDGMENT TO BE RECEIVED AT THE ISSUING OFFICE PRIOR TO THE HOUR AND DATE SPECIFIED MAY RESULT IN REJECTION OF YOUR OFFER. If by virtue of this amendment you desire to change an offer already submitted, such change may be made by telegram or letter, provided each telegram or letter makes reference to the solicitation and this amendment, and is received prior to the opening hour and date specified.

11 ACCOUNTING AND APPROPRIATION DATA (If required)

96X3122 Construction General RF
BB CP1 30 1KA 0 SC00 250/284

12 THIS BLOCK APPLIES ONLY TO MODIFICATIONS OF CONTRACTS/ORDERS

(a) ☐ This Change Order is issued pursuant to: _____
The Changes set forth in block 12 are made to the above numbered contract/order.

(b) ☐ The above numbered contract/order is modified to reflect the administrative changes (such as changes in pay office, appropriation data, etc.) set forth in block 12.

(c) ☐ This Supplemental Agreement is entered into pursuant to authority of: _____
It modifies the above numbered contract as set forth in block 12.

13 DESCRIPTION OF AMENDMENT/MODIFICATION (Organized by UCF section headings, including solicitation/contract subject matter where feasible.) WORK ORDER NO. 6

The Contractor is required to furnish all services and perform all work necessary to testing of sediments collected at Cleveland Harbor, in connection with the Cleveland Harbor, Section 111 Study, in strict accordance with the Scope of Work, Appendix "A", attached hereto and made a part hereof.

All work performed under this Work Order shall be completed within forty-two (42) calendar days following receipt by the Contractor of the Work Order Notice to Proceed.

Total amount of this Work Order No. 6 is at an amount not to exceed $5,798.00.

14 ☐ CONTRACTOR IS REQUIRED TO SIGN THIS DOCUMENT AND RETURN 1 COPIES TO ISSUING OFFICE.

15A NAME AND TITLE OF SIGNER (Type or print)

SAM R PETROCELLI
GEN MGR.

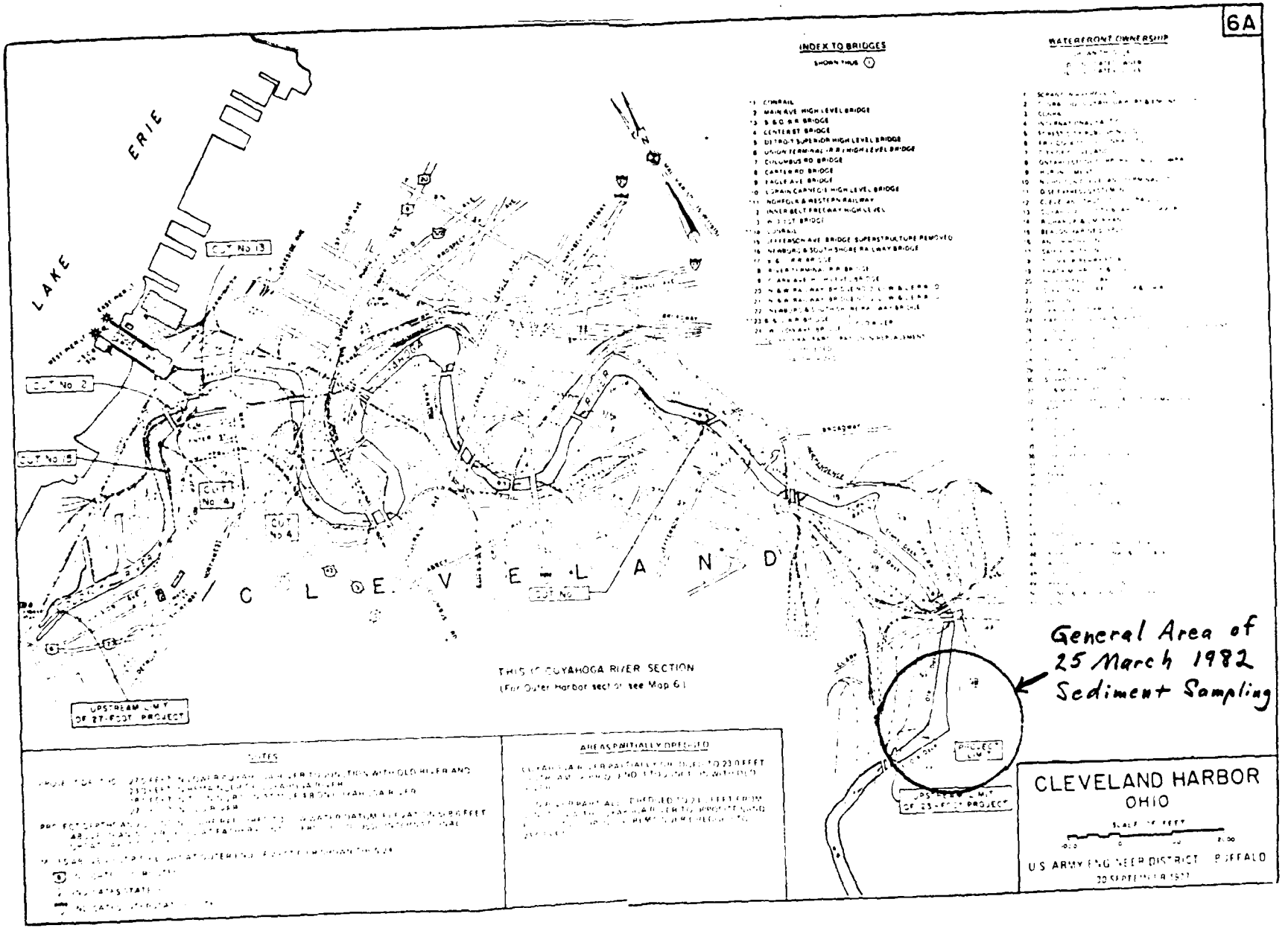
15B 12 April 1982

15C UNITED STATES OF AMERICA

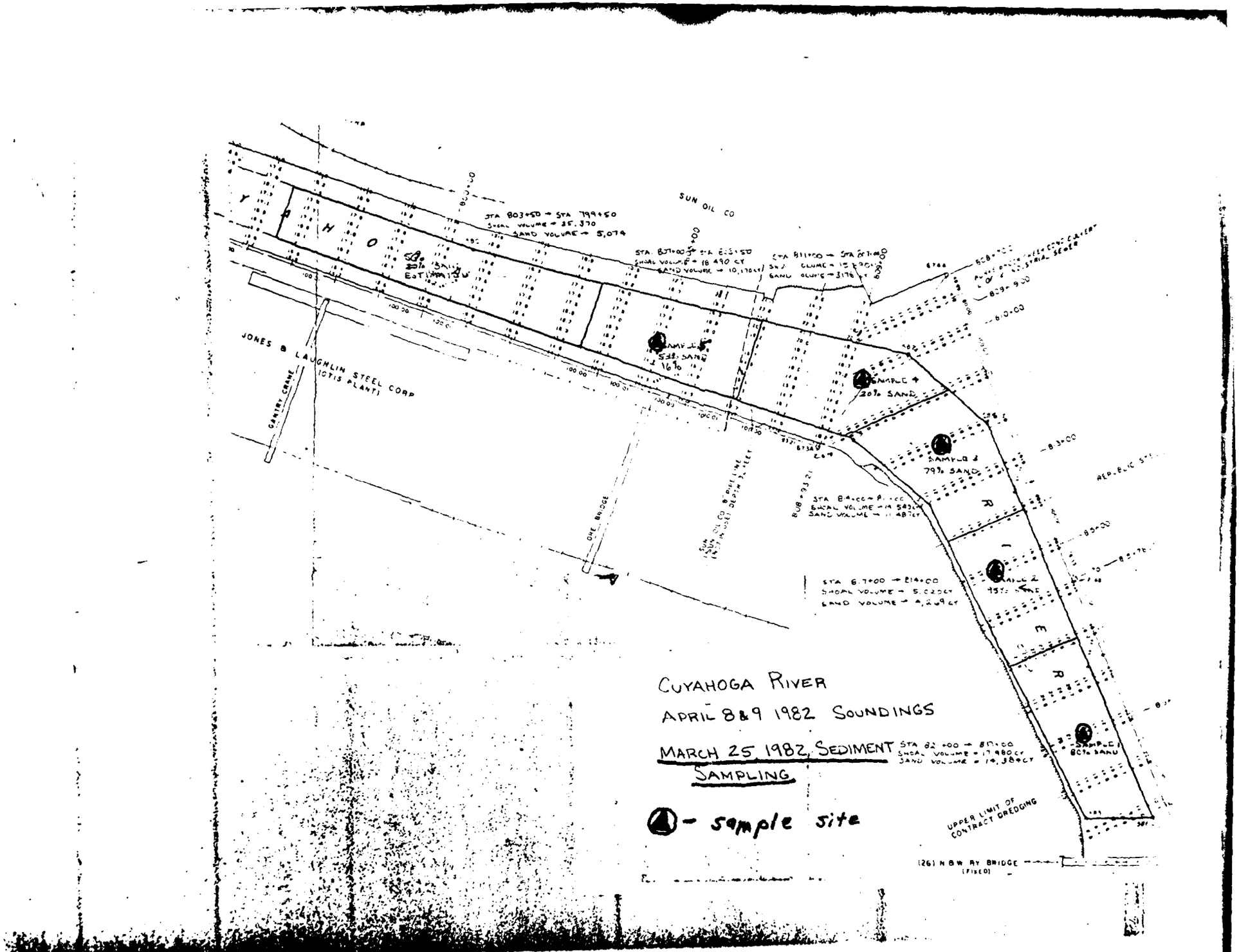
BY _____

16A NAME OF CONTRACTING OFFICER (Type or print)

16B



INCLOSURE ONE



INCLOSURE TWO

Description of Alternative IIA

Offshore Disposal of Dredged Sand - Bratenahl (Reach 8)

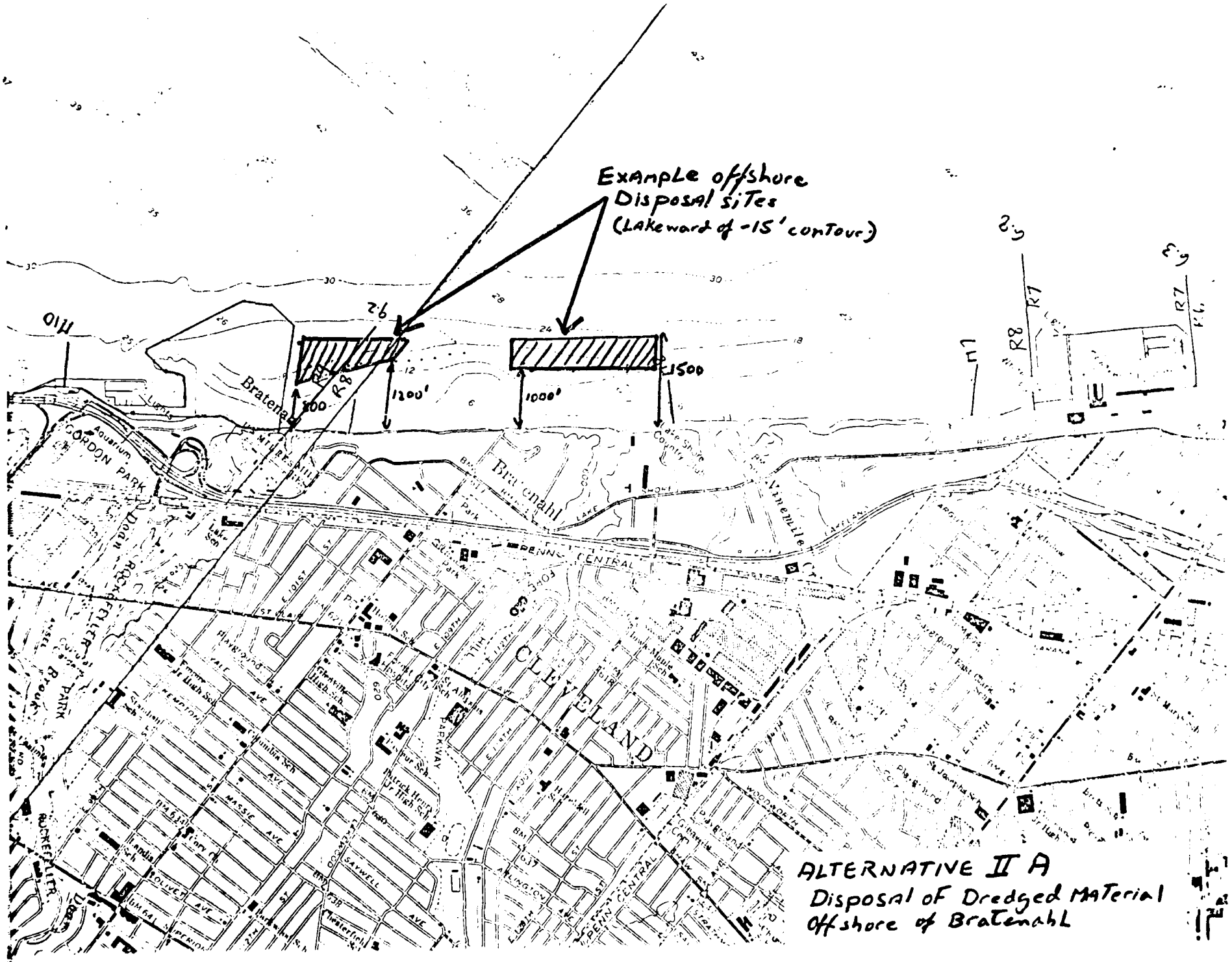
The computed annual sand and gravel yield of the Cuyahoga River due to Corps maintenance dredging activities is 45,000 cubic yards. However, only the material dredged from the upper end of the Federal navigation channel between Stations 821+00 and 811+00 contains sufficient sand (84%) to justify the consideration of nearshore disposal for littoral zone nourishment. The annual quantity of sand-sized material found in these dredgings is 40,000 cubic yards. A total of about 47,500 cubic yards of material (sand and other) is dredged annually between Stations 821+00 and 811+00.

One method of mitigating the Federal Harbor impacts to adjacent shores would be to divide the sand dredged from the upper Federal channel of the Cuyahoga River between two sites where the material would have gone (i.e., Bratenahl and Perkins Beach). The disposal pattern for the sand should mirror the ratio of the quantities which have been denied to the two impacted sites. Based on Corps supporting documentation, three-quarters of the sand dredged annually should be placed at Bratenahl and one-quarter of the material should be placed at Perkins Beach.

Under Alternative IIA, 30,000 cubic yards of sand dredged from the Upper Cuyahoga River navigation channel would be placed annually along the Bratenahl shoreline. The material would be placed about 1,000 to 1,500 feet offshore using bottom dump scows. Bottom dumping minimal water depth is 15 feet with 18 feet being the ideal shallowest depth (allowing for some wave action). A vicinity map showing potential disposal sites offshore of Bratenahl is attached.

If only 20 percent of the fill placed offshore of Bratenahl enters the nearshore littoral system, the annual quantity of sand replenishment at Bratenahl would be 6,000 cubic yards. This quantity approximately equals the calculated Federal impact due to interruption of the potential littoral contribution of the Cuyahoga River.

Attachment 5

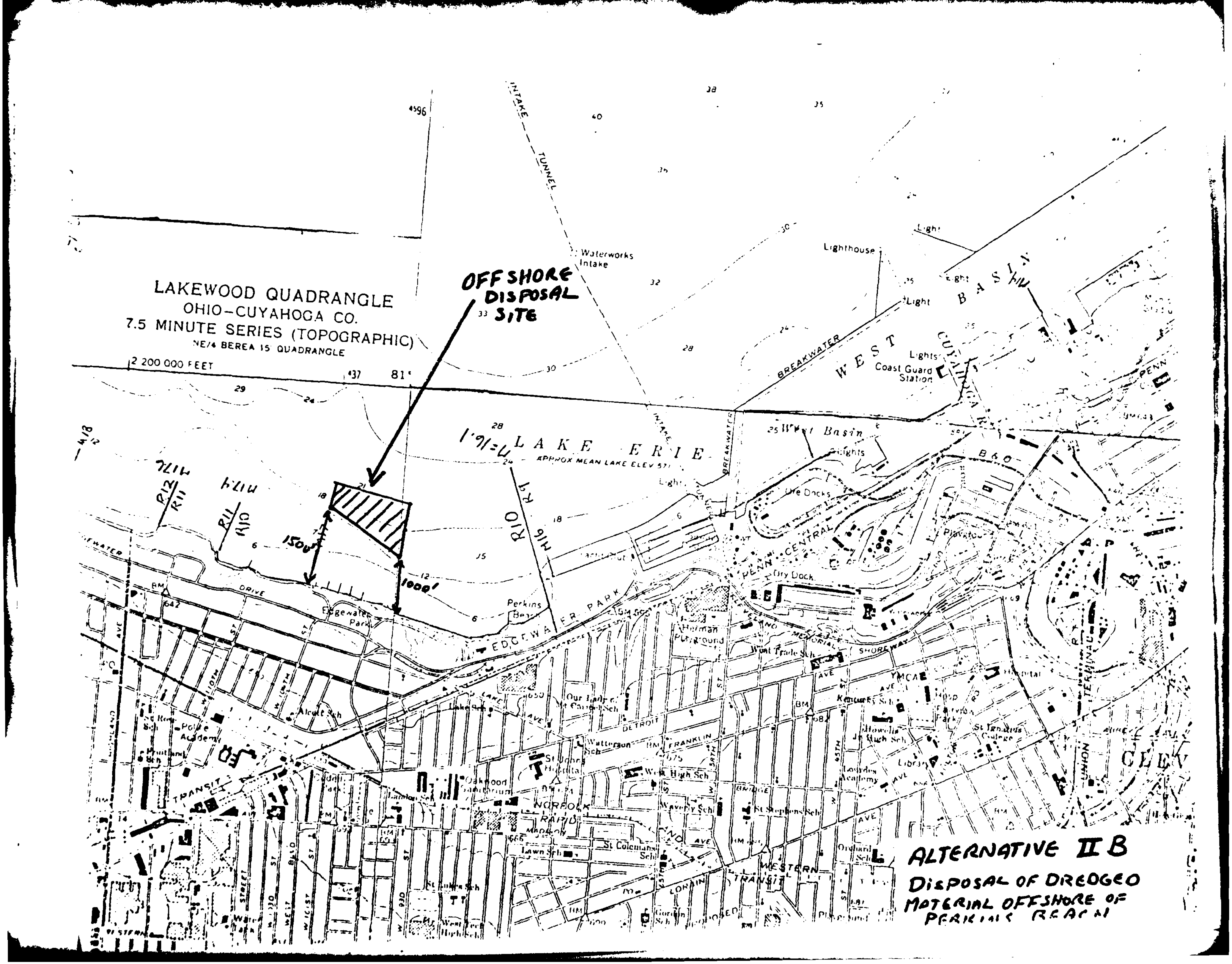

Example offshore
Disposal sites
(Lakeward of -15' contour)
1200'
1000'
1500
100
R8
R7
Bratenahl
CLEVELAND
GORDON PARK
PENN CENTRAL
ALTERNATIVE II A
Disposal of Dredged Material
Offshore of Bratenahl

Description of Alternative IIB

Offshore Disposal of Dredged Sand - Perkins Beach (Reach 10)

Under Alternative IIB, 10,000 cubic yards of sand dredged from the Upper Cuyahoga River navigation channel would be placed annually along the Perkins Beach shoreline. The material would be placed about 1,000 to 2,000 feet offshore using bottom dump scows. A vicinity map showing the potential sand disposal site offshore of Perkins Beach is attached.

If only 20 percent of the fill placed offshore of Perkins Beach enters the nearshore littoral system, the annual quantity of sand replenishment at Perkins Beach would be 2,000 cubic yards. This quantity approximately equals the calculated Federal impact due to interruption of the potential littoral contribution of the Cuyahoga River.


LAKEWOOD QUADRANGLE
OHIO-CUYAHOGA CO.
7.5 MINUTE SERIES (TOPOGRAPHIC)
NE/4 BEREA 15' QUADRANGLE
2 200 000 FEET
OFFSHORE DISPOSAL SITE
1500'
1000'
LAKE ERIE
APPROX MEAN LAKE ELEV 571
INTAKE TUNNEL
Waterworks Intake
Lighthouse
BREAKWATER
WEST BASIN
Coast Guard Station
West Basin
Ore Docks
Dry Dock
Perkins Beach
Edgewater Park
EDGEWATER PARK
DRIVE
PENN CENTRAL
SHOREWAY
DETROIT
FRANKLIN
LORAIN
WESTERN TRANSIT
NORFOLK
TERMINAL
UNION
CUYAHOGA R
B & O
R12 R11 M174
R11 R10 M174
R10 R9 M16
ALTERNATIVE II B
DISPOSAL OF DREDGED MATERIAL OFFSHORE OF PERKINS BEACH

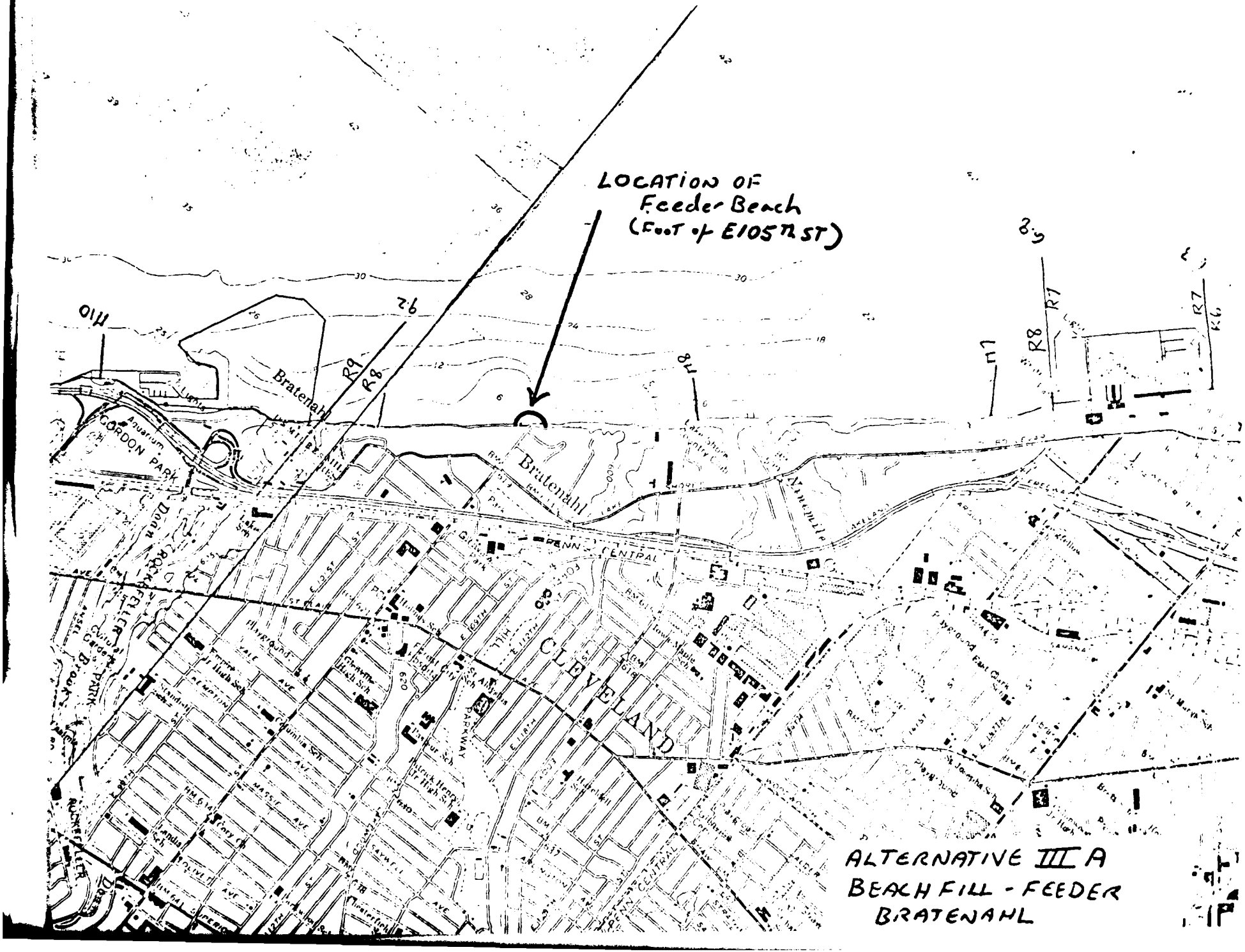
Description of Alternative IIIA

Feeder Beach Fill - Bratenahl (Reach 8)

Based on Buffalo District calculations, the Federal navigation project at Cleveland is responsible for denying the Bratenahl shore of 6,336 cubic yards of littoral material annually. Since some portion of a placed beach fill would be lost offshore, it would be necessary to place material in excess of the 6,336 cubic yards. The Buffalo District is assuming that 20 percent of the sand placed over the bluff face would be lost offshore.

Under Alternative IIIA, 7,600 cubic yards of material would be placed annually at Bratenahl to mitigate Federal damages. This material would be obtained commercially. Placement of the feeder beach would be by truck haul to the bluff edge and dumping over the embankment. It may be necessary to lower a small dozer (by crane) onto the feeder beach to spread the material for access by the wave climate.

The quantity of material involved in this alternative is small enough that only one feeder beach is under consideration at Bratenahl. Access for the feeder beach placement would be at the end of East 105th Street, which is located toward the updrift (west) end of the site. A vicinity map showing the potential location of the Bratenahl feeder fill is attached.


LOCATION OF
Feeder Beach
(East of E105 St ST)
Bratenahl
CLEVELAND
GORDON PARK
ROCKEFELLER PARK
PENN CENTRAL
ALTERNATIVE III A
BEACH FILL - FEEDER
BRATENAHL

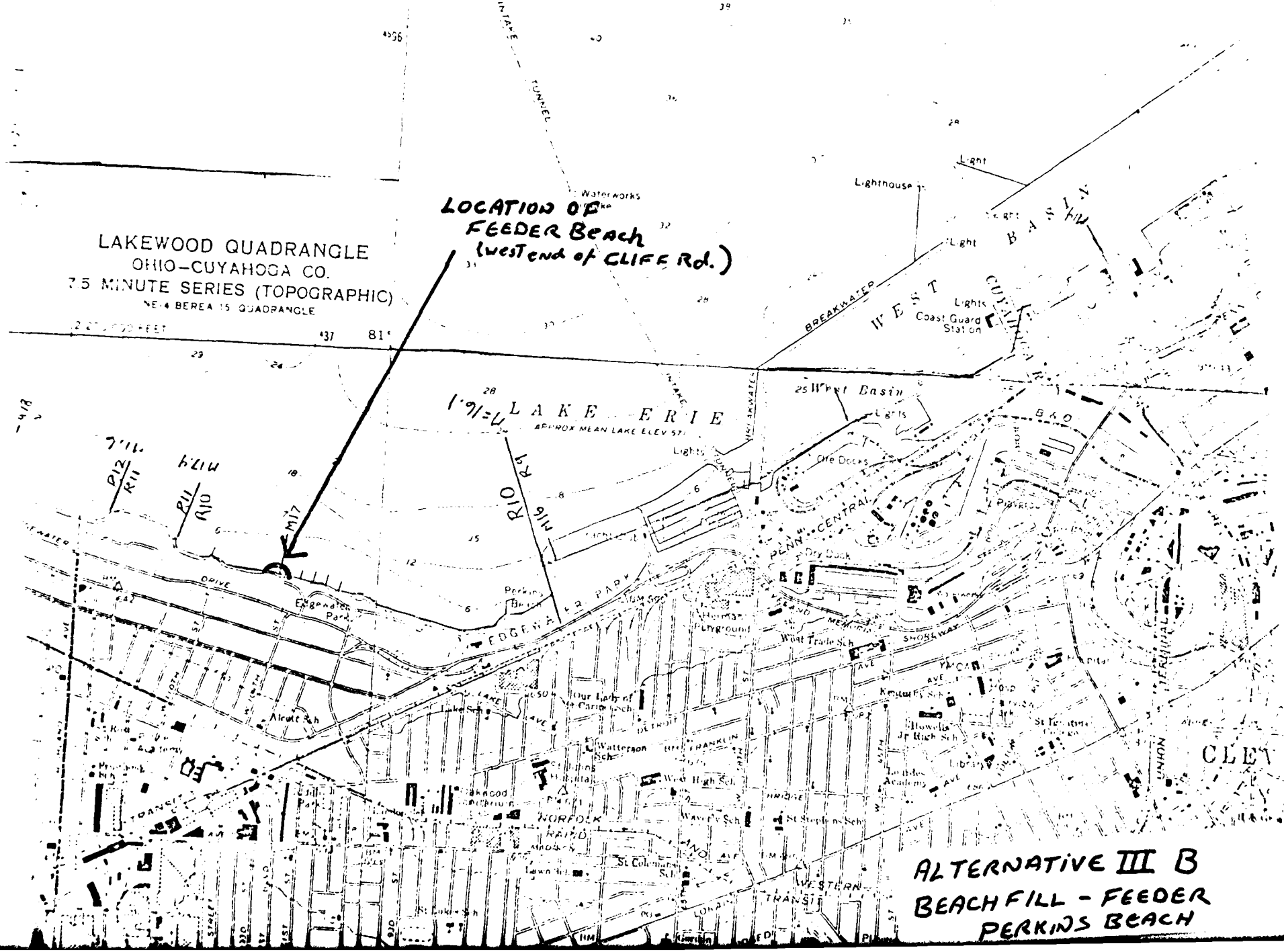
Description of Alternative IIIB

Feeder Beach Fill - Perkins Beach (Reach 10)

Based on Buffalo District calculations, the Federal navigation project at Cleveland is responsible for denying the Perkins Beach shore of 2,112 cubic yards of littoral material annually. Since some portion of a placed beach fill would be lost offshore, it would be necessary to place some excess material. The Buffalo District is assuming that 20 percent of the sand placed over the bluff face would be lost offshore.

Under Alternative IIIB, 2,500 cubic yards of material would be placed annually at Perkins Beach to mitigate Federal damages. This material would be purchased commercially or obtained from some upland source. Placement of the feeder beach would be by truck haul to the bluff edge and dumping over the embankment. It may be necessary to lower a small dozer (by crane) onto the feeder beach to spread the material for access by the wave climate.

The quantity of material involved in this alternative is small enough that only one feeder beach at Perkins Beach is under consideration. Access for the feeder beach placement would be at the west end of Cliff Road, which is located toward the updrift (west) end of the erosion site. A vicinity map showing the potential location of the Perkins Beach feeder fill is attached.



ALTERNATIVE III B
BEACH FILL - FEEDER
PERKINS BEACH

Description of Alternative IVA

Revetment - Bratenahl (Reach 8)

Under Alternative IVA, a rubblemound revetment would be constructed along the impacted shore at Bratenahl. The revetment would mitigate all Federally induced erosion and would completely halt natural erosion at the site for the project life of the structure (50 years).

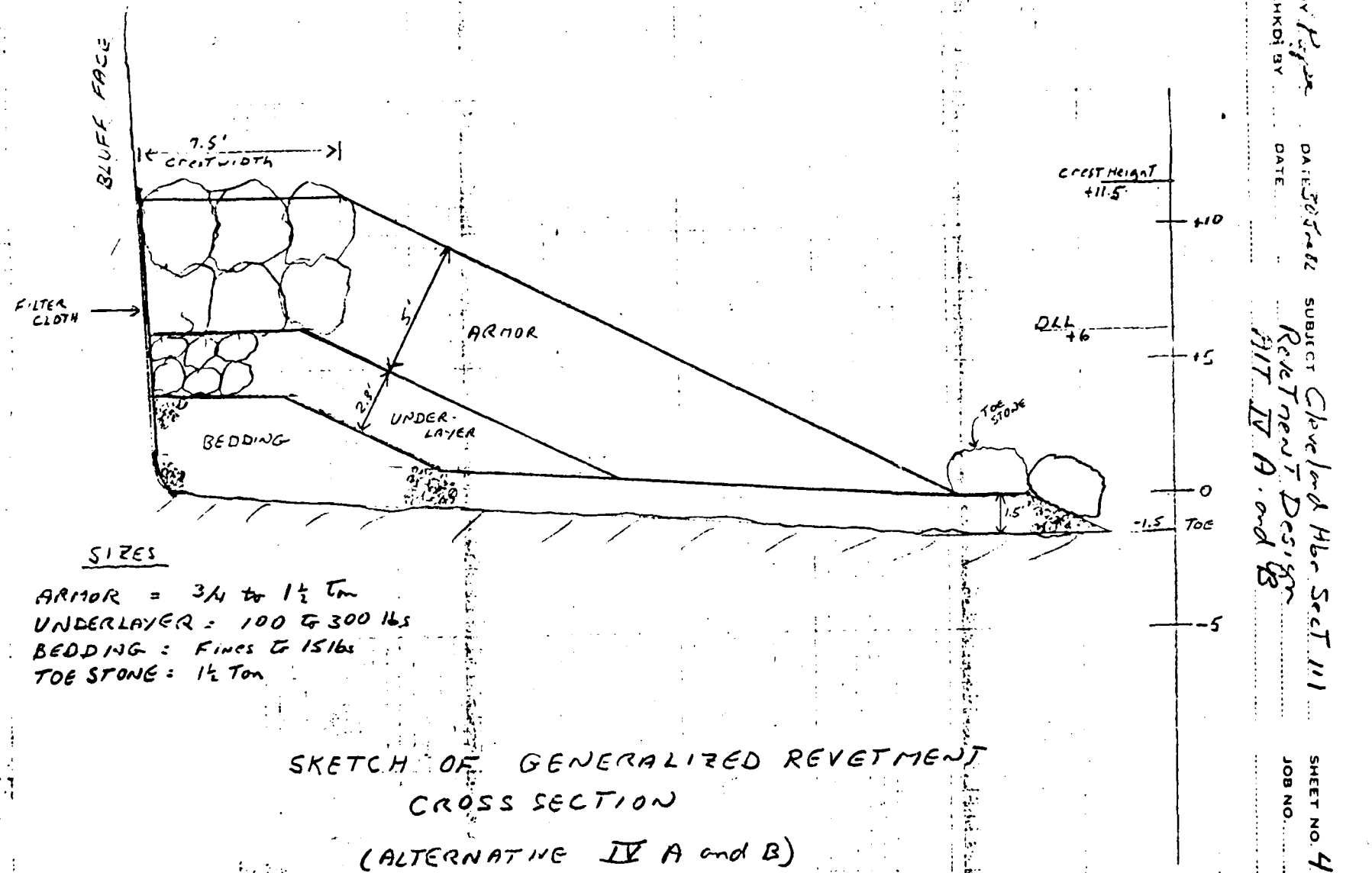
The Alternative IVA revetment for the Bratenahl shore would extend from the Federal Disposal Dike revetment on the east side of Gordon Park 12,000 feet to the east. It would cover the entire Bratenahl shore and the east end would be inside the west end accretionary tail of the White City Park fillet. This shoreline is irregular and contains a hodge-podge of various protective works. Some structural works may need to be removed or partially disassembled. Two creeks, which discharge into the lake along this shore, have moderately jettied outlets. The drainage off these creeks will need to be maintained. The revetment will be interrupted at these creeks and tied into the existing jetty structures. Some minor rehabilitation of these jetties may be necessary to assure stability of the revetments. Construction staging and access points would be from the east end at the White City Park/East 140th Street Sewage Treatment Plant (city of Cleveland) and from the west end at Gordon Park (city of Cleveland), or the Navy Center (U. S. Government). The rights-of-way at the north end of East 105th Street will be of some limited value, but the steep-faced high bluff would restrict access. Other construction access would have to be developed via easements through private lands.

A generalized cross section of the revetment is attached. The specific cross section throughout the site would vary as local water depths, bluff heights, and existing shore protection works vary. The detailed field data necessary for site specific design have not been collected for this stage of Corps planning.

BY Pope DATE 30 June 82 SUBJECT Cleveland Hbr Sect 111 SHEET NO. 4 OF 4

CHKD BY ..... DATE ..... Revetment Design ..... JOB NO. .....

Alt IV A. and B



SIZES

ARMOR = 3/4 to 1½ Ton
UNDERLAYER = 100 to 300 lbs
BEDDING = Fines to 15 lbs
TOE STONE = 1½ Ton

SKETCH OF GENERALIZED REVETMENT CROSS SECTION

(ALTERNATIVE IV A and B)

Description of Alternative IVB

Revetment - Perkins Beach (Reach 10)

Under Alternative IVB, a rubblemound revetment would be constructed along the impacted shore at Perkins Beach. The revetment would mitigate all Federally induced erosion and would completely halt natural erosion at the site for the project life of the structure (50 years).

The Perkins Beach revetment would not need to be extended over the entire length of impacted bluff since part of this area to the east has been protected and part of this area to the west is a shale bluff. The revetment would extend 1,400 feet west from the western end of the Edgewater Park revetment to the beginning of the vertical shale bluff near the west end of West Cliff Drive.

A generalized cross section of the revetment is attached. The specific cross section throughout the site would vary as local water depths, bluff heights, and existing shore protection works vary. The detailed field data necessary for site specific design have not been collected for this stage of Corps planning.

During construction, the Perkins Beach groin field would need to be partially removed, particularly at the landward connection, for stable placement of the revetment cross section. Some grooming, shaping, and seeding of the existing bluff may be necessary. Access and construction equipment stockpiling would be at the public parking lot at the west end of Edgewater Park.

Preliminary Mitigation/Enhancement Considerations for the Proposed Cleveland Section 111 Study Action Alternative

There is insufficient data at this time to determine the need for mitigation or the type of mitigation that might be required for the Cleveland Section 111 study. Mitigation will be more thoroughly evaluated during Stage 3 planning, as appropriate. Although plans for mitigation are not inluded in this Stage 2 documentation, opportunities for enhancement and the minimization of adverse environmental impacts were considered as discussed below.

For all of the proposed action alternatives, the reduction of water quality impacts would also assist in minimizing impacts to benthic macroinvertebrates, plankton, fish, and water-dependent recreation which may occur in the work areas. Recreational impacts could potentially be minimized by scheduling work for periods of low recreational use. Potential cultural resources impacts may be minimized through further inestigations, as appropriate, during Stage 3 planning efforts.

Under Alternatives IIA and IIB, short-term water quality impacts could be reduced by taking the following actions:

1. Discharging dredged material only while the disposal vessel is stationary.

2. Discharging only at one location in the disposal site.

3. Conducting operations in a manner to preclude the spillage of material between the dredging site and the disposal area.

4. Washing the dump scows only while stationary over the disposal area.

5. Washing the scows only as necessary to maintain operability of the equipment.

Appropriate sediment/benthic/fisheries sampling could be performed at the Alternative IIA and IIB disposal sites to insure that disposal would not cause significant, adverse benthic and/or fisheries impacts. Further testing of sediments from the upper Cuyahoga River navigation channel could be performed to further substantiate the 1982 sediment test results. The maximum benefits for the prevention of shore erosion could probably be achieved by placing the dredged sand as close as possible to the Lake Erie shoreline.

Under Alternatives IIIA and IIIB, water quality impacts could be minimized by the use of clean sand and by performing a minimal amount of work in the waters of Lake Erie. Potential impacts to vegetation and/or wildlife could probably be minimized by utilizing the smallest feasible work area along the top and side of the bluff at each construction site. The use of clean material dredged from the Cuyahoga River navigation channel could eliminate the requirement for sand from a commercial source. However, the placement of this material directly on the Lake Erie shoreline would result in added project costs due to the need for additional construction equipment and special handling techniques. Transport of the material by truck would

necessitate onshore unloading, dewatering, and additional handling time. Pumping the material to shore would necessitate the use of a pumpout facility and offshore pipeline which could be subject to damage by storm conditions.

Under Alternatives IVA and IVB, long-term benthic and fishery benefits could be maximized by extending the rubble structure into Lake Erie in an effort to enhance the maximum quantity of aquatic habitat. Placement of the rubble in a loose configuration would maximize the number of pockets, cracks, and crevices, thereby increasing the value of the fishery and benthic habitat. Impacts to vegetation and wildlife could probably be minimized by limiting the amount of bluff reshaping and by limiting the size and number of areas distributed along the bluff. Through the careful choice of a limited number of access sites for construction, some temporary impacts on the human environment might also be reduced. Increased fishing opportunities at Perkins Beach could potentially occur if the Perkins Beach groins were connected to the revetment and modified for use as shoreline fishing area.

Of all the proposed plans, Alternatives IVA and IVB probably have the greatest potential for environmental enhancement. No adverse environmental impacts of major significance have been identified to date for any of the proposed action alternatives.

PLANNING

United States Department of the Interior

IN REPLY REFER TO:

FISH AND WILDLIFE SERVICE
Columbus Field Office
3990 East Broad Street
Columbus, Ohio 43215

August 26, 1982

Colonel Robert R. Hardiman
District Engineer
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Attention: Charles Gilbert

Dear Colonel Hardiman:

This planning aid letter is in response to Mr. Gilbert's July 15, 1982 letter requesting our comments on the Cleveland Section 111 Shoreline Erosion Study, Cuyahoga County, Ohio.

This letter has been prepared under the authority of and in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 *et seq.*) and in compliance with the intent of the National Environmental Policy Act of 1969.

This Section 111 study has been focused primarily on erosion along the following two reaches of the Lake Erie shoreline:

1. The entire shoreline (reach 8, approximately 2 1/2 miles) within the limits of the Village of Bratenahl, Ohio; and

2. The Cleveland, Ohio shoreline from the western end of the stone riprap at Edgewater Park to the Eastern end of the Bramley Estate (reach 10, approximately 1 1/4 miles).

The Bratenahl shoreline (reach 8) is composed primarily of steep exposed banks. Numerous and various types of shoreline protection projects exist along this section of Lake Erie. Types of protection include stone riprap, broken concrete, and wood structures. The shoreline along Edgewater Park (reach 10) consists primarily of beach areas on the eastern end to steep shale banks on the west. Shore protection exists in the form of five open pile concrete groins on the western edge of Edgewater Park and other small shore protection works at various locations.

Other than the No Action Alternatives (IA and IB), three alternatives (IIB, IIIB, and IVB) are under consideration for the Perkins Beach (reach 10) and three alternatives (IIA, IIIA, and IVA) for the Bratenahl area (reach 8).

Under Alternative IIA, 30,000 cubic yards of sand dredged from Upper Cuyahoga River navigation channel would be placed along the Bratenahl shoreline. The material would be placed about 1,000 to 1,500 feet offshore using bottom dump scows in approximately 15 to 18 feet of water. If only 20 percent of the 30,000 cubic yards of sand placed offshore of Bratenahl enters the nearshore littoral system, it would approximate the calculated Federal impact due to interruption of the potential littoral contribution of the Cuyahoga River.

With Alternative IIIA, 7,600 cubic yards of clean sand, from an upland source, would be placed into the Bratenahl littoral zone on an annual basis. The material would be placed on the Bratenahl shoreline where 105th Street would enter the lake, if extended.

Under Alternative IVA, a 12,000-foot rubblemound revetment would be constructed along the Bratenahl shoreline. The revetment would extend from the Federal confined disposal facility near Gordon Park on the west to the vicinity of White City Park on the east. The revetment would be interrupted where two small streams enter Lake Erie. The proposed revetment would tie into existing jetties at these two locations.

Based on Buffalo District Corps of Engineers calculations, the Federal navigation project at Cleveland is responsible for denying the Perkins Beach area of approximately 2,000 cubic yards of littoral material annually. Alternative IIB would place 10,000 cubic yards of Cuyahoga River dredged sand offshore of the Perkins Beach shoreline in about 15 to 20 feet of water. It is assumed that 20 percent of the fill placed offshore would enter the nearshore littoral system.

Under Alternative IIIB, 2,500 cubic yards of sand would be placed at Perkins Beach on an annual basis. This sand would be obtained from a commercial source and trucked to the beach area.

With Alternative IVB, a rubblemound revetment would be constructed along the impacted shore at Perkins Beach. The revetment would extend 1,400 feet west from the western end of the Edgewater Park revetment to the beginning of the veritcal shale bluff near the west end of West Cliff Drive. During construction, the Perkins Beach groin field would need to be partially removed for stable placement of the revetment cross section.

Fish and Wildlife Resources

Aquatic resources of the Cleveland area are many and varied. Species composition have changed over the years toward more pollution tolerant populations due to the overall reduction in water quality. In general, water quality deteriorates from west to east across the Cleveland Harbor area and improves with distance from shore.

Approximately 50 species of benthic microinvertebrates (composed primarily of aquatic oligochaetes) have been reported in the Cleveland nearshore zone (Pliodzinkos, 1979). Plankton has greatly increased in the past 50 years

and pronounced spring and fall pulses of phytoplankton occur in Cleveland Harbor. The dominant species are diatoms, including Asterconella spp., Melosira spp., and Fragilaria spp. Green and blue-green algae also contribute to phytoplankton blooms in Cleveland Harbor (Hartley and Van Vooren, 1977; U. S. Army Corps of Engineers, 1978).

Fish population in the Cleveland area are under stress from an overall degradation of the ecosystem. The fish community is dominated by gizzard shad, emerald shiner, yellow perch, and spottail shiner. Table 1 lists those species of fish that were collected in Cleveland Harbor and adjacent marinas, 1972-1974. The yellow perch is the most important species in terms of the sport fish harvest.

White et al. described the following as principle fish nursery zones in the Cleveland area: the mouth, lower one mile, and adjacent shoreline of Rocky River, the mouth and adjacent shoreline of Chagrin River, and Cleveland Harbor and adjacent marinas. It is probable that these same areas provide spawning habitat for several species. During 1972-1974, the following species were observed spawning within Cleveland Harbor: goldfish, pumpkinseed, largemouth bass, and yellow perch (White et al, 1975).

Boat and shoreline fishing is an important recreational activity for thousands of residents of the Cleveland area. The principle area for shoreline fishing in the Cleveland Harbor area is the riprap shoreline along Edgewater Park. For the years 1975 to 1977, Baker et al. (1979) reported an average summer harvest of approximately 100,000 fish by shore anglers and 200,000 fish by boat anglers in the West Cleveland area.

The proposed project lies within the range of the following Federally endangered (E), threatened (T), or proposed (P) species:

Name/Status	Habitat	Distribution
Indiana bat (E) *Myotis sodalis*	Caves and riparian	Statewide

Suitable habitat for the Indiana bat is very limited in the project area. Since most of the proposed work will be conducted in the lake, on the shoreline, and in the Cuyahoga River, the proposed project should not have significant impacts on any endangered species present. The above endangered species comments provide informal consultation only, and do not fulfill the requirements of Section 7 of the Endangered Species Act as amended.

Discussion

With Alternatives IIA and IIB, sand, which would be placed offshore of the Village of Bratenahl and Perkins Beach, would be obtained from the upper Cuyahoga River navigation channel. Sediment samples were collected from five sites for analysis to determine if the material would be suitable for

introduction into the Lake Erie littoral drift system. The sediment sample locations in the navigation channel of upper Cuyahoga River were upstream of Clark Avenue and downstream of the upper limits of the Federal channel. The sample station numbers were 819, 815, 812, 810, and 805, with 819 being the most upstream location. Approximately 47,500 cubic yards of material is annually dredged from the upper end of the Federal navigation channel between stations 821+00 and 811+00.

The grain size analyses of the sediments from sample stations 810 and 805 revealed that the percent sand was 20 and 55 respectively. Thus, we do not consider material from these stations as suitable for placement in the Lake Erie littoral system. Since this was a "one shot" analysis, we recommend additional analyses be conducted on the Upper Cuyahoga River navigational channel material in the spring of 1983 or before the material is dredged and placed in the littoral system.

Organic, inorganic, and trace metal analyses of the sediment samples from the various locations have been completed. Based on the results of these analyses, it does not appear that significant adverse impacts on the aquatic resources would result due to placement of this material in the Lake Erie littoral zone.

Tentative offshore locations have been identified along the Bratenahl Village and Perkins Beach shoreline for the placement of sand. With the selection of a preferred disposal site, we recommend that aquatic surveys be conducted to identify any site specific spawning, nursery, or feeding areas that may be impacted by placement of fill material.

Selection of Alternative IIIA or IIIB (Feeder Beach Fill) should have minimal impacts on the aquatic resource of the Perkins Beach or the Bratenahl shoreline area since clean sand would be placed on the shoreline where it would be accessable to wave action.

Construction of Alternative IVA or IVB (Rubblemound Revetment) would probably have a net positive impact on the aquatic resources of the Perkins Beach and the Bratenahl shoreline areas. Construction of a 1,400-foot and a 12,000-foot rubblemound revetment at Perkins Beach and Bratenahl respectively, could provide habitat for various species of micro-and macroinvertebrates. Also, the revetment could provide spawning, nursery, and feeding habitat for several fish species. If these alternatives are selected, we recommend that modifying the revetments for use as a shoreline fishing areas be investigated.

In conclusion, if Alternatives IIA and IIB are selected as the preferred alternatives, future planning should define the disposal area and the site specific aquatic habitat of that area. All construction alternatives proposed for the Bratenahl shoreline and Perkins Beach area probably would not cause significant adverse impacts on the aquatic resources of the area. However, it is our opinion that Alternatives IVA and IVB (Rubblemound Revetment) may provide a net benefit for the aquatic resources of the Cleveland area.

We look toward continued coordination throughout the project planning phase.

Sincerely yours,

Ken Mullen
for Kent E. Kroonemeyer
Supervisor

cc: ODNR, Div. of Water, R. Bernhagen, Columbus, OH
Chief, Ohio Division of Wildlife, Columbus, OH
ODNR, Outdoor Recreation Service, Attn: M. Colvin, Columbus, OH
U.S.EPA, Office of Environmental Review, Chicago, IL
Ohio EPA, Attn: J. Albrecht, Columbus, OH

References

Baker, C.T., M.R. Rawson, and D.L. Johnson. 1979. Ohio's Annual Lake Erie Creel Census. Dingell-Johnson Project F-35-R, Study 3, Final Report. Ohio Department of Natural Resources, Div. of Wildlife, Columbus, OH. 104pp.

Hartley, S.M. and A.R. Van Vooren. 1977. The Fishing Potentials, Special Management Areas, and Their Interaction with Dredge Spoil Sites in Lake Erie. Ohio Department of Natural Resources, Div. of Wildlife Coastal Zone Management Program, Columbus, OH. 308pp.

Pliodzinkas, A.J. 1979. A General Overview of Lake Erie's Nearshore Benthic Macroinvertebrates. Center for Lake Erie Area Research. Ohio State Univ., Columbus, OH. Report 126. 83pp.

U. S. Army Corps of Engineers. 1978. Final Environmental Impact Statement: Cleveland Harbor Navigation Study, Cleveland, Ohio. U. S. Army Engineer District, Buffalo, NY

White, A.M., M.B. Trautman, E.J. Foell, M.P. Kelty, and R. Gaby. 1975. Water Quality Baseline Assessment for the Cleveland Area, Lake Erie. Vol.II-Fishery. U.S. Environmental Protection Agency. Region V. Chicago, IL. Report EPA-905/9-75-001. 181pp.

Table 1. Relative Abundance of Fishes Collected in the Cleveland Harbor and Adjacent Marinas (revised July 1974)*

Species	No. Collected	% of Total
Longnose gar	1	0.01 %
Alewife	92	0.85
Gizzard shad	2,525	23.43
Chinook salmon	9	0.08
Coho salmon	42	0.39
Rainbow trout	2	0.02
Rainbow smelt	323	3.00
Northern pike	15	0.14
Carp	64	0.59
Goldfish	97	0.90
Golden shiner	393	3.65
Longnose dace	1	0.01
Creek chub	1	0.01
Blacknose dace	1	0.01
Emerald shiner	4,092	37.97
Striped shiner	1	0.01
Spottail shiner	903	8.38
Spotfin shiner	6	0.06
Sand shiner	35	0.31
Minic shiner	6	0.06
Fathead minnow	1	0.01
Bluntnose minnow	74	0.69
Stoneroller	2	0.02
Quillback	1	0.01
Black redhorse	1	0.01

Table 1. (continued) Relative Abundance of Fishes Collected in the Cleveland Harbor and Adjacent Marinas (revised July 1974)*

Species	No. Collected	% of Total
Golden redhorse	2	0.02
Shorthead shiner	1	0.01
White sucker	89	0.83
Channel catfish	2	0.02
Brown bullhead	23	0.21
Black bullhead	14	0.13
Stonecat	13	0.12
Trout-perch	153	1.42
Brook silverside	3	0.03
White bass	223	2.07
White crappie	80	0.74
Black crappie	11	0.10
Rock bass	5	0.05
Largemouth bass	3	00.3
Warmouth	1	0.01
Green sunfish	3	0.03
Bluegill	4	0.04
Pumpkinseed	34	0.32
Walleye	2	0.02
Yellow perch	1,254	11.64
Logperch	1	0.01
Freshwater drum	170	1.58
TOTALS	10,777	100.05 %
47 Species		

* from White, et al., 1975

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V
230 SOUTH DEARBORN ST
CHICAGO, ILLINOIS 60604

REPLY TO ATTENTION OF:

3 AUG 1982

Mr. Charles E. Gilbert
Chief, Planning Division
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

RE: 309-TR-COE-OH(82511)

Dear Mr. Gilbert:

We have reviewed the information sent in your 15 July 1982 letter regarding the Cleveland Section III Shoreline Erosion Study. You requested our comments on the April 1982 sediment analysis in the Cuyahoga River and any comments we may have on potential environmental impacts of the proposed project alternatives.

Based on the physical and chemical analyses of the sediments at sampling sites 1, 2 and 3 (Stations 819+0, 815+0 and 812+0), the sediments appear to be predominantly clean, fine grained sands. This may make the dredged sediment from these areas of the Cuyahoga River suitable for use as beach nourishment material. Because this would be a beneficial use of dredged material, we recommend further consideration of this alternative.

We do not anticipate that the other proposed alternatives (feeder beach fill and revetment construction) will result in significant, adverse environmental impacts, and we have no specific comments on them. We would like to emphasize again though that the use of clean sand dredged from the navigation channel could prove to be a beneficial use of dredged material. This alternative deserves further investigation. The use of this material in the construction of a feeder beach fill (pumping the clean sand from the dredge site or a hopper dredge onto the shoreline) should be investigated as well.

Thank you for the opportunity to review and comment on the proposed project. Please continue to coordinate this project with us. If you have any questions about our comments, please call Mr. James Hooper of my staff, at 312/886-6694.

Sincerely yours,

Barbara Taylor Backley

Barbara Taylor Backley, Chief
Environmental Review Branch
Planning and Management Division

Attachment 8- Comments by the USEPA

TELEPHONE OR VERBAL CONVERSATION RECORD

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.

DATE: 26 August 1982

SUBJECT OF CONVERSATION: Cleveland Section 111 Study

INCOMING CALL

PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION

PERSON CALLED	OFFICE	PHONE NUMBER AND EXTENSION

OUTGOING CALL

PERSON CALLING	OFFICE	PHONE NUMBER AND EXTENSION
Heicher	NCBPD-EA	X2175

PERSON CALLED	ADDRESS	PHONE NUMBER AND EXTENSION
Jim Hooper	USEPA Region 5	FTS 886-6694

SUMMARY OF CONVERSATION

I asked Mr. Hooper whether USEPA Region 5 would recommend any further testing of Cuyahoga River sediments if Alternative IIA or Alternative IIB were to be implemented.

Mr. Hooper stated that he felt that the sediments were clean and that no further chemical tests would be necessary. He felt that the Buffalo District may wish to perform additional physical analyses for its own engineering considerations.

Mr. Hooper did state that it would be wise to obtain sediment grab samples from each of the proposed offshore disposal sites to determine the type of bottom substrate that would be impacted by disposal. If the disposal site substrate consisted of material which might be expected to provide significant benthic and/or fish spawning habitat, such as sand/gravel, he felt that additional fisheries studies of the

(continued)

TELEPHONE OR VERBAL CONVERSATION RECORD

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.

DATE: 26 August 1982

SUBJECT OF CONVERSATION: Cleveland Section III Study (continued)

INCOMING CALL		
PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION
PERSON CALLED	OFFICE	PHONE NUMBER AND EXTENSION

OUTGOING CALL		
PERSON CALLING	OFFICE	PHONE NUMBER AND EXTENSION
Heicher		
PERSON CALLED	ADDRESS	PHONE NUMBER AND EXTENSION
Jim Hooper		

SUMMARY OF CONVERSATION

disposal site(s) would be warranted.

Mr. Hooper has still not received copies of Alternatives IIIA and IVA. He will contact the Buffalo District with USEPA comments on these alternatives as soon as possible.

David W. Heicher, Biologist
Environmental Resources Branch

DA FORM 1 APR 66 751 REPLACES EDITION OF 1 FEB 58 WHICH WILL BE USED.

TELEPHONE OR VERBAL CONVERSATION RECORD

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.

DATE: 30 August 1982

SUBJECT OF CONVERSATION: Cleveland Section III Study

INCOMING CALL

PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION
Jim Hooper	USEPA Region 5	FTS 886-6694
PERSON CALLED	**OFFICE**	**PHONE NUMBER AND EXTENSION**
Heicher	NCBPD-ER	X2175

OUTGOING CALL

PERSON CALLING	OFFICE	PHONE NUMBER AND EXTENSION
PERSON CALLED	**ADDRESS**	**PHONE NUMBER AND EXTENSION**

SUMMARY OF CONVERSATION

Written descriptions of Alternatives IIIA and IVA have been received by USEPA Region 5. They have no problem with either alternative. A letter to this effect will be sent to the Buffalo District.

David W. Heicher, Biologist
Environmental Resources Branch

DA FORM 1 APR 66 751 REPLACES EDITION OF 1 FEB 59 WHICH WILL BE USED.

UNITED STATES
ENVIRONMENTAL PROTECTION AGENCY
REGION V
230 SOUTH DEARBORN ST
CHICAGO, ILLINOIS 60604

REPLY TO ATTENTION OF:

2 SEP 1982

Colonel R. Hardiman
District Engineer
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Colonel Hardiman:

We are in receipt of your August 23, 1982 letter about the Cleveland Section III Shorelines Erosion Study and have reviewed the two additional action alternatives: feeder beach fill at Bratenahl, and a revetment at Bratenahl.

Based on our review of these alternatives, we do not expect either of them to have a significantly adverse environmental impects, and we do not have specific comments on them at this time.

Please continue to coordinate this project with us. If you have any questions about our review, please call Mr. James Hooper of my staff, at 312/886-6694.

Sincerely yours,

James P. Hooper

for Barbara Taylor Backley, Chief
Environmental Review Branch
Planning and Management Division

ODNR
Ohio Department of Natural Resources
OFFICE OF OUTDOOR RECREATION SERVICES
Fountain Square • Columbus, Ohio 43224 • (614) 265-6395

August 23, 1982

C.F. Gilbert, Chief
Planning Section
U.S. Department of the Army
Buffalo District, Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Mr. Gilbert:

The Department has reviewed the information forwarded on 15 July by your agency regarding the Stage 2 documentation for the Cleveland III shoreline erosion study.

The Department encourages development of the most effective alternative solution to the Lake Erie shoreline erosion problem at Cleveland. In your 15 July letter, there were seven alternatives listed with pairs of alternatives developed for both Perkins Beach and Bratenahl. Neither alternative III nor alternative IV was listed for Bratenahl, but we understand that such alternatives do exist and details will be forwarded. Alternative VB has been deleted since 15 July.

The Department thus far has no specific objection to any of the proposed alternatives.

The Corps is not considering complete restoration of eroded sites but rather is seeking to mitigate present and future effects. We believe a more comprehensive plan ought to be considered involving restoration.

A general observation is that ensuring bluff stability through dewatering is a prerequisite to developing any successful mitigation alternative.

We offer these specific comments:

1) Bulk chemical analysis of sediment collected from Cleveland Harbor indicates that the pollutant concentrations fall within acceptable levels with the exception of arsenic.

The data obtained for the tested metals and organics was compared to guidelines established by the USEPA, Region V. The acceptable maximum level in mg/kg for arsenic was 3.2 and the samples contained approximately 11 mg/kg. Further, the test results for sample #003 (Sample Identification COE-D99, Table 6 - Selected Inorganic Parameters in Cleveland Harbor Sediment Samples) indicate that the sediment contains close to the amount specified for heavily polluted sediments (observed = 1825 mg/kg dry, USEPA guidelines specify 2060 mg/kg dry as heavily polluted). However, these two parameters are sometimes not reliable indicators of overall sediment quality.

2) Part of Cleveland Lakefront State Park is contained within reach 10. The beach receiving the majority of use within this reach is the area marked Perkins Beach on the topographic maps included in the Corps information package. Any selected alternative should not reduce the recreational use of this beach. The beach located in the area of the groin field receives informal use only and we do not expect that any alternative would unduly restrict its use.

3) Alternate IIA, IIB - We are concerned that sand placed offshore might not move onshore in quantities expected. Also, sediment grain sizes indicate that the sediment on the lakeshore is a coarser sand than that obtained from the river. Consequently, the dredged sand might not be stable on the existing beach.

4) Alternative IVB - The description indicates that partial removal of the existing Perkins Beach groin field would be necessary for stable placement of the revetment. We recommend that plans include a reconnecting of the groins to the shoreline.

In summary, we do not anticipate that any of the alternatives listed will result in significant environmental impacts. As such, we have no further comments regarding fish and wildlife resources, State threatened/endangered species or existing environmental conditions in the study area. We thank you for the opportunity to provide these comments.

Sincerely,

Roger D. Hubbell

Roger D. Hubbell, Chief
Office of Outdoor Recreation Services

RDH/dlw

TELEPHONE OR VERBAL CONVERSATION RECORD

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.

DATE: 8 September 1982

SUBJECT OF CONVERSATION: Cleveland Section 111 Study Alternatives

INCOMING CALL		
PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION
PERSON CALLED	**OFFICE**	**PHONE NUMBER AND EXTENSION**

OUTGOING CALL		
PERSON CALLING	OFFICE	PHONE NUMBER AND EXTENSION
Heicher	NCBPD-ER	X2175
PERSON CALLED	**ADDRESS**	**PHONE NUMBER AND EXTENSION**
Steve Wegert	ODNR, Columbus, OH	614-265-6413

SUMMARY OF CONVERSATION

Mr. Wegert stated that the ODNR had considered Alternatives III A and IV A prior to sending their 23 August 1982 letter to the Buffalo District. They have no further comments on Alternatives III A and IV A.

David W. Heicher, Biologist
Environmental Resources Branch

DA FORM 1 APR 66 751 REPLACES EDITION OF 1 FEB 59 WHICH WILL BE USED.

ODNR
Ohio Department of Natural Resources
OFFICE OF OUTDOOR RECREATION SERVICES
Fountain Square • Columbus, Ohio 43224 • (614) 265-6395

September 27, 1982

Colonel Robert R. Hardiman, District Engineer
Buffalo District
U.S. Army Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

RE: CLEVELAND SECTION 111 SHORELINE EROSION STUDY

Dear Colonel Hardiman:

This letter is in response to your 23 August 1982 letter informing us of additional action alternatives for the Cleveland 111 Shoreline Erosion Study. We have reviewed the descriptions of Alternative IIIA and IVA and offer the following comments.

ALTERNATIVE IIIA, Feeder Beach Fill - Bratenahl (Reach 8)

The feeder beach will supply the littoral zone with a volume of sand comparable to the volume supplied by the Cuyahoga River. Before construction of Cleveland Harbor, this volume would augment existing beaches and would complement existing shore protection structures. This alternative is also more aesthetically pleasing and may provide recreation area for this stretch of shore. However, more than 20% of the beach fill used for Alternative IIIA may be lost offshore because of steep nearshore slopes (along this stretch of Cuyahoga County, water depth 500 feet from shore is 20-25 feet compared to 10-15 feet along the rest of the Ohio lake shore). This alternative will not provide immediate benefit to the eastern part of the beach. In fact, if offshore loss of sand is high there may be no benefit to the eastern part of the reach. Jetties at Ninemile Creek may also impede eastward movement of sand.

ALTERNATIVE IVA, Revetment - Bratenahl (Reach 8)

Alternative IVA will provide immediate, more certain and more effective protection from wave erosion of the shore. However, it will also require removal or partial disassembly of existing shore protection structures. It will not be as aesthetically pleasing as a sand beach and will in fact cover or destroy the few existing beaches. Further, this alternative will not reduce erosion in nearshore areas. As erosion of the nearshore zone continues, water depths will increase and more wave energy will reach shore.

Nearshore disposal of sand dredged from the upper reaches of the navigation channel in the Cuyahoga River was listed as alternatives IIA and IIB for mitigating shore erosion at Cleveland (letter from Gilbert to Lucas, 15 July 82). If sand from the upper navigation channel in the Cuyahoga River is not used to nourish the beach and nearshore zones perhaps this sand could be segregated in the diked disposal-area, presently Gordon Park, so that it might be recovered at a later date and used for nourishment of the littoral zone.

I hope these comments are helpful. If there are questions, please contact the Environmental Review Section at 614-265-6413.

Sincerely,

Roger D. Hubbell, Chief
Office of Outdoor Recreation Services

RDH/dlw

cc: Don Guy, Geologist
Lake Erie Section, OGS

CPC

CLEVELAND CITY PLANNING COMMISSION

501 CITY HALL · CLEVELAND, OHIO 44114 216 / 664-2210

July 20, 1982

Mr. David Heicher
U. S. Army Corps of Engineers
Environmental Resources Branch
Buffalo District
1776 Niagara Street
Buffalo, New York 14207

Re: Cleveland Harbor Project; Environmental Assessment

Dear Mr. Heicher:

As per Charles Gilbert's request for data, attached is the following:

1. 1970-1980 Census Data - By Tract
2. Population Projections - Cleveland Sub-Areas by RPC
3. Park Facilities - Project Vicinity
4. Economic Data - Cleveland Area
5. Zoning - Project Vicinity

I would suggest you contact the Regional Planning Commission for current detailed land use data for the areas in question (216/861-6805); our data is quite generalized. For housing value data, contact NOACA (216/241-2414) and ask for Tom Bier who has access to this data. Please specify the specific community facilities data you need, and for what service area.

Please contact us if we can be of any further assistance.

Sincerely,

BRUCE H. FREEMAN

Bruce H. Freeman, AICP
Data Services

BHF:sw

cc: Hunter Morrison

Enclosures

Attachment 10

REGIONAL PLANNING COMMISSION
CUYAHOGA COUNTY, OHIO
415 THE ARCADE / CLEVELAND, OHIO 44114 / 216·861·6805
CARL S. BOHM, DIRECTOR

June 22, 1982

Mr. David Heicher
Environmental Resources Branch
U. S. Army Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Dear Mr. Heicher:

Please find enclosed information pertaining to the Cuyahoga County, Ohio shoreline, as per your request. Included in the information is a 1977 land use map, a 1975 generalized zoning map, and a copy of a draft report on the County's shoreline, prepared in 1977 as part of Ohio's Coastal Zone Management Program.

From the 1980 Census, the following information is provided for Cleveland Census Tract 1011 (Reach 10) and Bratenahl Census Tract 1928 (Reach 8):

	Tract 1011	Tract 1928
1980 Population	7,376	1,485
% Minority	5.0%	4.0%
% Over 60	16.5%	18.9%
Housing Units	3,683	685
No. Rental Units	2,726	142
Median Housing Value	$43,800	$68,300
Median Contract Rent	$197	$228

We hope this information is helpful to you. Please let us know if we can be of further assistance.

Yours truly,

James Kastelic

James Kastelic
Managing Planner
For Carl S. Bohm, Director

JK:pg

Enclosure

cc: Al Ruksenas, Commissioner's Office

Attachment 11

Ohio Historic Preservation Office

Ohio Historical Center I-71 & 17th Avenue Columbus, Ohio 43211 (614) 466-1500

June 18, 1982

Mr. Charles E. Gilbert
Chief, Planning Division
Department of the Army
Buffalo District
Corps of Engineers
1776 Niagara Street
Buffalo, New York 14207

Re: Environmental Assessment
Cleveland Section III Shoreline
Erosion Study

Dear Mr. Gilbert:

This is in response to your letter of June 14, 1982 concerning the establishment of coordination with the Ohio Historic Preservation Office in connection with the above study.

The staff has reviewed our files for information concerning Reach 8 and Reach 10. The Howard M. Hanna, Jr. Residence, located at 11505 Lake Shore Boulevard and listed on the National Register, is within close proximity to the shoreline in the Reach 8 area. There are a number of other residences along Lake Shore Boulevard that have been surveyed for the Ohio Historic Inventory which appear to be eligible for the National Register. The Ohio Historic Inventory files are available for your use to determine the exact location of these properties. There does not appear to be any recorded cultural resources in the Reach 10 area.

It should be noted that it is the responsibility of the Agency official to provide the documentation on cultural resources *in any* project area. Due to time and staff limitations the Ohio Historic Preservation Office is unable to respond to requests for "any available information on known cultural resources". Our records and files are available to you and we would be happy to assist anyone from the Corps who visited our office.

Thank you for contacting our office concerning your study.

Sincerely,

W. Ray Luce

W. Ray Luce
State Historic Preservation Officer

WRL/CS:vb

Attachment 12- Comments by the SHPO

TELEPHONE OR VERBAL CONVERSATION RECORD

For use of this form, see AR 340-15; the proponent agency is The Adjutant General's Office.

DATE: 13 August 82

SUBJECT OF CONVERSATION: Cleveland Harbor Section III, Cultural Resources Coordination

INCOMING CALL

PERSON CALLING	ADDRESS	PHONE NUMBER AND EXTENSION

PERSON CALLED	OFFICE	PHONE NUMBER AND EXTENSION

OUTGOING CALL

PERSON CALLING	OFFICE	PHONE NUMBER AND EXTENSION
Tim Daly	Environmental Res. Br.	(716) 876-5454 ext. 2175

PERSON CALLED	ADDRESS	PHONE NUMBER AND EXTENSION
Catherine Stroup	Ohio Historic Preservation Office, Columbus, OH	(614) 466-1500

SUMMARY OF CONVERSATION

I called Ms. Stroup to inform her office of the two additional alternatives (III A & IV A) received from the project manager this week. I read the project descriptions verbatum to her, including site locations as received from the project manager. It was her expressed opinion that these additional alternatives would make no difference as far as cultural resources coordination, and that a follow-up letter or written alternatives' summary would be unnecessary.

DA FORM 1 APR 66 751 REPLACES EDITION OF 1 FEB 58 WHICH WILL BE USED.

United States Department of the Interior
NATIONAL PARK SERVICE
MIDWEST REGION
1709 JACKSON STREET
OMAHA, NEBRASKA 68102-2571

IN REPLY REFER TO:

August 5, 1982

1201-01(a)(MWR-PH)

District Engineer
U.S. Army Engineer District, Buffalo
Attn: Environmental Resources Branch
1776 Niagara Street
Buffalo, New York 14207

Dear Sir:

We are writing in response to a July 23, 1982 letter from Mr. Charles E. Gilbert, Chief, Planning Branch, concerning shoreline erosion along Lake Erie at Cleveland, Ohio. We are not aware of any significant historic cultural resources which would be affected by any potential mitigative measures which would be adopted. We suggest, however, that you coordinate the project with Mr. Ray Luce, Ohio State Historic Preservation Officer, Ohio Historical Society, Interstate 71 at 17th Avenue, Columbus, Ohio 43211.

Thank you for giving us this opportunity to comment.

Sincerely,

John Kawamoto
Associate Regional Director
Planning and Resource Preservation

United States Department of the Interior

NATIONAL PARK SERVICE
MIDWEST REGION
1709 JACKSON STREET
OMAHA, NEBRASKA 68102

IN REPLY REFER TO:

August 18, 1982

1603-02(MWR-PH)

Mr. Tim Daly
U.S. Army Engineer District, Buffalo
1776 Niagara Street
Buffalo, New York 14207

Dear Mr. Daly:

We have reviewed the additional information concerning shoreline erosion along Lake Erie near Cleveland, Ohio. We are not aware of any significant historic cultural resources which would be impacted by this proposed undertaking. However, we recommend that you coordinate the project with Dr. Ray Luce, Ohio State Historic Preservation Officer, Ohio Historic Society, Interstate 71 and 17th Avenue, Columbus, Ohio, 43211.

Thank you for giving us the opportunity to comment on this proposed project.

Sincerely,

John Kawamoto
Associate Regional Director
Planning and Resource Preservation

CLEVELAND HARBOR, OH
SECTION 111

APPENDIX E
COST ESTIMATES

April 1983

AD-A134 242 CLEVELAND HARBOR OHIO SECTION 3 STUDY TERMINATION REPORT(U) CORPS OF ENGINEERS BUFFALO NY BUFFALO DISTRICT APR 83

3/3

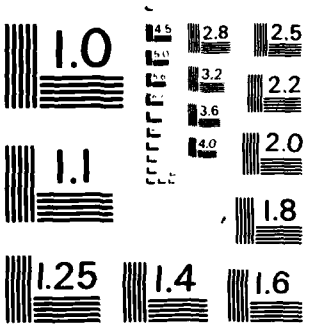
UNCLASSIFIED

F/G 13/2 NL

END

DATE FILMED

DTIC



July 1982 Price Levels

REASONABLE CONTRACT ESTIMATE					SHEET 1 OF 7
PROJECT Cleveland Harbor Section 111					INVITATION NO.
ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
1.	Disposal in Dike #14				
	a.) Dredging	50,000	c.y.	6.20	310,000
	TOTAL				$ 310,000
2.	Disposal @ Bratenahl Site Alternative IIIa				
	a.) Dredging	50,000	c.y.	4.50	225,000
	TOTAL				$ 225,000
3.	Disposal @ Perkins Beach Site Alternative IIC				
	a.) Dredging	50,000	c.y.	3.70	185,000
					$ 185,000

ENG FORM APR 69 1738 SUPERSEDES ENG FORM 1738, 1 APR 54, WHICH IS OBSOLETE. Repp/3 Sept 82

8/3/93

[redacted] SHEET 2 OF 7

PROJECT CLEVELAND HARBOR - SECTION 111 (7,600CY) ALT. III "A" FEEDER BEACH - BRATENAHL

INVITATION NO.

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
1.	SITE WORK				
	a) Maintenance of Streets	—	L.S.	—	$ 15,000
2.	BEACHFILL	11,400	TON	$ 3.00	91,200
3.	MOB & DEMOB	—	L.S.	—	5,000
	TOTAL EST. CONTRACTORS EARNINGS				$ 111,200
	CONTINGENCIES @ 25% ±				27,800
	TOTAL EST. CONTR. EARN. PLUS CONTING.				139,000
	Engineering & Design				14,000
	Supervision & Administration				17,000
	TOTAL EST. FIRST COST				$ 170,000

ENG FORM APR 87 1738 SUPERSEDES ENG FORM 1738, 1 APR 54, WHICH IS OBSOLETE.

8/3/92

[redacted] ESTIMATE — SHEET 3 OF 7

PROJECT CLEVELAND HARBOR – SECTION 111 (2,500c.y) ALT III B FEEDER BEACH – PERKINS BEACH — INVITATION NO.

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
1.	SITE WORK				
	a) Maint. of Roads	—	L.S.	—	5,000
2.	BEACHFILL	3,750	TON	$8.00	30,000
3.	MOB – DEMOB		L.S.		2,000
	TOTAL EST. CONTRACTORS EARNINGS				$37,000
	CONTINGENCIES @ 25% ±				9,000
	TOTAL EST. CONT. EARN. PLUS CONTIN.				$46,000
	Engineering & Design				4,500
	Supervision & Administration				5,500
	TOTAL EST. FIRST COST				$56,000

ENG FORM APR 67 1738 SUPERSEDES ENG FORM 1738, 1 APR 54, WHICH IS OBSOLETE.

Subject CLEVELAND HARBOR - SECTION 111
Computation of E&D - S&A (FEEDER BEACHES)
Computed by JAK 8/3/82 Checked by _____ Date _____

ALT III "A" FEEDER BEACH
BRATENAHL

Engineering & Design 10%(139,000) = 13900 = 14,000

Supervision & Administration
SUPERVISION & INSPECTION
139,000 (.07) = 9,730

OVERHEAD
E&D 13900 (0.232) = 3,225
S&I 9,730 (0.393) = 3,824
7,049

TOTAL S&A $16,779 USE 17,000

$31,000

ALT III "B" FEEDER BEACH
PERKINS BEACH

Engineering & Design 10%(46,000) = 4,600 = 4,500

Supervision & Administration
SUPERVISION & INSPECTION
46,000 (0.07) = 3,220

OVERHEAD
E&D 4,600 (0.233) = 1,067
S&I 3,220 (0.393) = 1,265
2,332

$5,552 USE 5,502

10,002

9/3/82

[redacted] ESTIMATE — SHEET 5 OF 7

PROJECT CLEVELAND HARBOR – SECTION 111
ALT. IV A BRATENAHL SHORE REVETMENT (13,000 LF) — INVITATION NO.

ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
1.	SITE WORK				
	a) Debris Clearing (Lump)	10.6	Acre	$ 2300	$ 24,380
	b) Mob. Ext. Struct. Works	10	Ea	5000	50,000
2.	ARMOR STONE - 3/4 TO 1 1/2 T	61,800	Ton	37.00	3,036,600
3.	UNDERLAYER STONE - 100# - 300#	25,100	Ton	33.00	828,300
4.	BEDDING STONE - FINES TO 1.5"	62,700	Ton	25.00	1,567,500
5.	TOE STONE - 1 1/2 TON	7,600	Ton	37.00	281,200
6.	FILTER CLOTH	17,300	S.Y.	3.20	55,360
7.	Mob. & Demob	—	L.S.	—	117,000
	TOTAL ESTIMATED CONTRACTOR'S EARNINGS				$ 6,950,340
	CONTINGENCIES @ 25% ±				1,737,660
	TOTAL EST. CONTR. EARNINGS PLUS CONTING.				$ 8,688,000
	Engineering and Design				742,000
	Supervision and Administration				900,000
	TOTAL FIRST COST				$ 10,330,000

ENG FORM APR 67 1738 SUPERSEDES ENG FORM 1738, 1 APR 54, WHICH IS OBSOLETE.

8/3/82

[redacted]					SHEET 6 OF 7
PROJECT CLEVELAND HARBOR – SECTION 111 ALT IV B PERKINS BEACH SHORE REVET. (1400LF)					INVITATION NO.
ITEM NO.	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	ESTIMATED AMOUNT
1.	SITE WORK				
	a) Debris Clearing (Medium)	1.4	Acre	$2,700	3,780
	b) [illegible] Cont.				
	of Groin Field	5	Ea.	5,000	25,000
	c) [illegible]	[illegible]	LF.	0.35	[illegible]
2.	ARMOR STONE – 3/4T-1 1/2T	9,500	Ton	37.00	351,500
3.	UNDERLAYER STONE – 100#-300#	2,900	Ton	33.00	95,700
4.	BEDDING STONE – Fines to 15#	7,300	Ton	25.00	182,500
5	TOE STONE – 1 1/2 TON	900	Ton	37.00	33,300
6.	FILTER CLOTH	2,000	S.Y.	3.20	6,400
7.	MOB & DEMOB	—	L.S.	—	36,000
	TOTAL ESTIMATED CONTRACTORS EARNINGS				754,970
	CONTINGENCIES @ 25% ±				137,030
	TOTAL EST. CONTR. EARNINGS PLUS CONTING.				942,000
	Engineering and Design				94,000
	Supervision and Administration				114,000
	TOTAL FIRST COST				$1,150,000

ENG FORM 1738 APR 67 SUPERSEDES ENG FORM 1738, 1 APR 54, WHICH IS OBSOLETE

Subject CLEVELAND HARBOR - SECTION III
Computation of E&D - SIA (REVETMENT)
Computed by JAK 8/3/82 Checked by _____ Date _____

ALT IV "A"
BRATENAHL

Engineering & Design 10% (7,440,000) = 744,000 USE 740,000

Supervision & Administration
SUPERVISION & INSPECTION
7,440,000 (0.07) 520,800

OVERHEAD
E&D 744,000 (0.232) = 172,608
S&I 520,800 (0.393) = 204,674
377,282

899,082 USE 925,000

1,640,000

ALT IV "B"
PERKINS BEACH

Engineering & Design 10% (942,000) = 94,200 94,200

Supervision & Administration
SUPERVISION & INSPECTION
942,000 (0.07) 65,940

OVERHEAD
E&D 94,200 (0.232) = 21,854
S&I 65,940 (0.393) = 25,914
47,768

113,698 USE 114,200

209,000

END

DATE
FILMED

11 — 83

DTIC